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ABSTRACT

This final report of a statewide computer literacy study for the state of Alaska is divided into several sections. A general introduction provides the history of the project and an outline of its three stages: (1) a national review of the status of computer literacy through a computerized literature search; (2) a telephone survey of representatives of Alaskan school districts and documentation collection from the State Department of Education to determine the status of computer literacy in Alaska; and (3) a 3-day computer literacy workshop for representatives of the educational and industrial sectors. The workshop participants were divided into two major planning groups--one to develop definitions and objectives for citizen computer literacy for the state, and the other to develop definitions and objectives for vocational computer literacy. Sections II-IV of the report provide an in-depth analysis of each of these three phases. In addition, data collected through the telephone survey, a summary of the results, and three conclusions are reported for the second stage of the study. The report of the citizen literacy group is contained in Section III and the report of the vocational computer literacy group in Section IV; Section V presents a summary of the recommendations of both groups. A separately bound appendix contains two keynote addresses, a seven-page selected bibliography, a report of a 1982 school survey, a planning conference participant list, and the agenda for the Alaska Statewide Computer Literacy Planning Conference. (JB)

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STATEWIDE COMPUTER LITERACY STUDY

- FINAL REPORT -

JANUARY 1983

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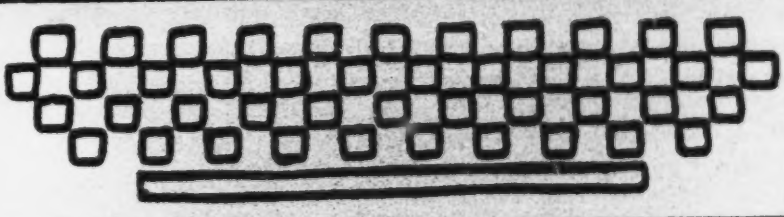

Conducted by:
SYSTEMS FOR TRAINING & APPLIED RESEARCH, INC.

FINAL REPORT

STATEWIDE COMPUTER LITERACY STUDY

Department of Education

Office of Educational
Technology & Telecommunications

January 1983

Prepared by: Systems for Training and Applied Research, Inc.

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EXECUTIVE SUMMARY

Electronic technology is having a major impact on society. The computer, an information processing tool, is altering the day-to-day functions of government, business, education, and our personal lives. Given the impact and potential benefits computing offers Alaska's citizens, the Alaska State Legislature directed the State Department of Education to conduct a study of educational computing in Alaska. The Twelfth Legislature (SB 719) requested that the Department "develop a plan in cooperation with other appropriate State and local agencies for improving the computer literacy of Alaska public school students; the plan should also include recommended programs of increasing computer literacy for the Alaska population who are not enrolled in educational institutions."

The Alaska Department of Education has taken a leadership role in implementation of innovative educational technology. Three successful computer applications resulted from a four and a half year Department design and demonstration project: a statewide electronic mail system, an educational electronic resource data base, and a series of eight computer-assisted high school courses. The Department also helped make available to educators a large collection of computer-assisted courseware from the Minnesota Educational Computing Consortium (MECC). Encouraged by these initiatives, school districts have acquired varying inventories of computer courseware for instruction.

In response to the request of the Twelfth Alaska Legislature, the Department of Education contracted with Systems for Training and Applied Research to conduct a statewide computer literacy study. This project seems particularly timely in view of recent studies on the state of the Alaskan economy (e.g., see Anchorage Times, December 15, 1982, p. B-4; Report

of the Roundtable Discussion on Alaska's Fiscal Future, November 19, 1982, Council on Economic Policy). Specifically, the dependence of the State's economy upon the expenditure of State funds which are tied to oil revenues is being recognized. These revenues are expected to be on the decline in future years, and this should have a profound effect on the State's ability to pump funds into the economy. This would suggest that for practical reasons the State ought to make every effort to capitalize on initiatives begun during the period of favorable funding. One of these initiatives has been in educational computing.

Study Procedures and Methods

The study was designed to provide a basis for devising a plan for adult and student computer literacy in the State of Alaska. It involved the following three stages:

1. a) The status of computer literacy on the national scale was reviewed. This was done by conducting a computerized search of the ERIC (Educational Research Information Catalog), by contacting the National Science Foundation Directorate of Computer Education, and by a search of major publications and library holdings.

   b) The status of computer literacy in the State of Alaska was studied. This was done by collecting documentation from the State Department of Education, and conducting a survey of the schools in the State.

2. A three-day workshop was conducted in December in Anchorage. The first day was open to the public and included further exploration of the status and future of computer literacy in the U.S. and Alaska, and provided an opportunity for input from the public. In this General Session, Andrew Molnar of the National Science Foundation, Office of

Science and Engineering Personnel and Education, and Joseph Deken, a professor in the School of Business, University of Texas at Austin, and author of the widely-acclaimed book, The Electronic Cottage, presented papers on the topics of occupational literacy and citizen literacy in computers. During the second and third days, a limited number of representatives of the public and private sectors participated in two workgroups designed to provide guidelines for development of a State plan for a computer literate population of students and adults who would be capable of active participation in modern society. Those selected to participate in the second and third days of the workshop were chosen to represent a diversity of regions, vocational and commercial interests, and occupations from throughout the State.

3. All of the data that were collected in the previous two stages were consolidated into this report recommending procedures and guidelines for the development of a State plan for implementation of computer literacy within the State of Alaska for all children and adults.

National Computer Literacy

Existing computer literacy programs universally begin in the early grades, usually kindergarten. The programs might be implemented separately from other educational programs of the school, or become integrated with other programs. For example, creative writing may be integrated with word processing, spelling taught and tested by computer, and math and science "experienced" on the computer through simulation of experimentation or practice exercises coordinated with traditional textbook readings and classroom sessions.

Computers appear to be gaining prominence in all aspects of society and life. However, one of the most prominent areas of growth in computer use is education. According to the National Center on Educational Statistics, the

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presence of microcomputers is increasing at the current rate of about 50% per year (report dated September 7, 1982, on Instructional Use of Computers in Schools). In comparison, the level of use in Alaska has increased more rapidly than that. In the IST program alone, Apple II computers were used at seven sites for two courses during the 1979-80 school year. By 1981-82, use had increased to over 100 sites with six courses. In 1982-83, eight of these courses are being used widely throughout the State. Currently, it is estimated that there are between 1,000 and 1,200 microcomputers used in the Alaskan schools. Alaska has about 8% of the microcomputers currently used in educational settings in the U.S. This is a larger number than would be expected given that the State has about 1% of the students who used computers in schools in the U.S. in 1981-82. Despite these impressive figures, Alaska still has only about 1 computer for educational purposes for every 75 students.

Survey of the Status of Computer Literacy in Alaska

In order to determine the status of computer literacy offerings in the schools of Alaska, 140 educators from all districts were surveyed by telephone. In addition, public responses were obtained during the mid-December meeting in Anchorage. Major conclusions resulting from the survey were:

1) More of the computer literacy programs in urban areas are just beginning or are at a starting entry level than is true in the rural areas. This suggests the need for a multi-level computer literacy program initially emphasizing entry skills in urban areas.

2) Overall, Alaska has an excellent level of computer literacy among its professional educators when compared to other states, and this should continue to provide an outstanding basis for improving computer literacy within the State. This edge should be exploited by continued efforts through the Department of Education focusing on technology education.

3) Industrial and business aspects of computer literacy require greater attention from the DOE.

Summary of Workgroups

The workgroup on citizen computer literacy recommended the following definition of computer literacy:

> Computer literacy for the State of Alaska means developing all of our human resources in an information and communications-based society. A society that fosters computer literacy is one that affords its citizens opportunities to acquire computer literacy skills, knowledge, and attitudes appropriate to individual needs.

This citizenry should:

1.0 Possess operational computer skills

2.0 Understand and make effective use of current and emerging roles of computers in modern society

3.0 Understand the ethical and social issues related to current and emerging roles of computers in modern society

4.0 Evaluate the advantages and disadvantages of various computer applications

5.0 Participate in decisions related to the application of computer-based technology in their personal lives in modern society.

In regard to teacher training, the group recommended that training be provided primarily by coordinated efforts of the Department of Education, the University of Alaska system, the community college system, and school districts. A variety of modes of delivery should be utilized to offer training to teachers and administrators. Topics that should be included in the training include how to teach computing, classroom management of computers, and specialized topics in computing which are part of a teacher's field of specialization. Finally, it was strongly recommended that the DOE establish standards for the training, but that no add-on certification standards be proposed for teachers currently holding valid teaching certificates. The DOE

should work with the University system to build computer literacy into existing teacher training programs.

The corporate business community of Alaska is moving rapidly to the decentralization of computing and the use of multiple computer workstations and numerous microcomputers. Video screens are replacing printed reports as conveyors of information, and the trend is towards every employee having a computer workstation. In order to complete the delineation of computer literacy in modern society, the vocational computer literacy group adopted an additional definition of computer literacy:

> Vocational computer literacy is a functional/ operational knowledge of computers and their applications in the modern work environment. This competency should be at a level compatible with other knowledge and skills a person has acquired.

In order to supplement general citizen goals, the vocational computer literacy group recommended five vocational education programs:

1.0 Make all citizens comfortable and confident with computers

2.0 Provide information about computer careers

3.0 Develop computer literacy at employable level in all fields

4.0 Allow for communication and information access with computers

5.0 Teach systems analysis and programming.

The highest priority was given to establishing a statewide public information and communications network funded by the State and accessible from any Alaska telephone. This network would be a collection of computers and terminals at different sites interconnected by a communications satellite. The network would consolidate existing Alaska special networks, and make them

accessible to all citizens. It would allow voice, data and, eventually, video communication among all sites in Alaska. The group felt that the statewide public information and communications network would be a foundation on which teacher training and the development of other educational programs could build, and that planning for this network should start immediately. Next in priority, the group recommended the hiring and training of several types of teachers and administrators for all levels of the State's educational system, elementary through university levels, to staff the recommended educational programs. While these first two steps are being taken, the implementation of educational programs 1.0, 2.0, 3.0 and 5.0 should take place.

I. INTRODUCTION

Electronic technology is having a major impact on society. The computer, an information processing tool, is altering the day-to-day functions of government, business, education, and our personal lives. Given the impact and potential benefits computing offers Alaska's citizens, the Alaska State Legislature directed that the Alaska State Department of Education conduct a study of educational computing in Alaska. The Twelfth Legislature (SB719) requested that the Department "develop a plan in co-operation with other appropriate State and local agencies, for improving the computer literacy of Alaska public school students; the plan should also include recommended programs of increasing computer literacy for the Alaska population who are not enrolled in educational institutions."

Computers were first introduced in Alaskan schools primarily through applications developed by Alaska's Department of Education. Three major computer applications resulted from a four and one-half year Department design and demonstration project for educators: a statewide electronic mail system, an educational electronic resource data base, and a series of eight computer-assisted high school courses. The Department also helped make available to educators a large collection of computer-assisted course-ware from the Minnesota Educational Computing Consortium (MECC). School districts acquired varying inventories of commercially available computer courseware for instruction.

Over 1,000 microcomputers now support instruction in Alaska's K-12 schools, with roughly 50% of all hardware being purchased within the last 15 months. Roughly 10% of Alaskan teachers have received introductory level computer literacy training to date.

To respond to the request of the Twelfth Alaska Legislature, the Department of Education contracted with Systems for Training and Applied Research to conduct a statewide computer literacy study. This is the final report of that study. Section II of the report details the study's procedures and methods which were divided into three stages. Initially, the status of computer literacy on a national scale was reviewed through relevant publications. The status of computer literacy in the State of Alaska was determined through a phone survey. Secondly, a three-day workshop was conducted in Anchorage in which representatives of the educational and industrial sectors were divided into two major planning groups; one to develop definitions and objectives for citizen computer literacy for the State of Alaska, and the other to develop definitions and objectives for vocational computer literacy for the State. Two definitions were considered necessary with respect to the variety of ways that computers are used. The numerous factors influencing the way life in modern society will be affected by the new technology would appear to suggest that different but overlapping areas of study would be necessary. For example, citizen literacy might address cultural, family relationship and recreational topics; while vocational literacy might consider business, management, and administrative topics. Finally, this report was produced consolidating all information obtained in the earlier stages. The report of the citizen literacy group is contained in Section III of this document, while the report of the vocational computer literacy group is contained in Section IV. Section IV presents a summary of the recommendations of both groups. Bound separately is an appendix to this report which contains speeches, surveys and meetings that took place as part of this study.

II. STUDY PROCEDURES AND METHODS

The study was designed to provide a basis for devising a plan for adult and student computer literacy in the State of Alaska. It involved the following three stages:

1. a) The status of computer literacy on the national scale was reviewed. This was done by conducting a computerized search of the ERIC (Educational Research Information Catalog), by contacting the National Science Foundation Directorate of Computer Education, and by a search of major publications and library holdings.

   b) The status of computer literacy in the State of Alaska was studied. This was done by collecting documentation from the State Department of Education, and conducting a survey of the schools in the State.

2. A three-day workshop was conducted in December in Anchorage. The first day was open to the public and included further exploration of the status and future of computer literacy in the U.S. and Alaska, and provided an opportunity for input from the public. In this General Session, Andrew Molnar of the National Science Foundation, Office of Science and Engineering Personnel and Education, and Joseph Deken, a professor in the School of Business, University of Texas at Austin, and author of the widely-acclaimed book, The Electronic Cottage, presented papers on the topics of occupational literacy and citizen literacy in computers. During the second and third days, a limited number of representatives of the public and private sectors participated in workgroups designed to provide guidelines for development of a State plan for a computer literate population of students and adults

who would be capable of active participation in modern society. Those selected to participate in the second and third days of the workshop were chosen to represent a diversity of regions, vocational and commercial interests, and occupations from throughout the State.

3. All of the data that were collected in the previous two stages were consolidated into this report recommending procedures and guidelines for the development of a State plan for implementation of computer literacy within the State of Alaska for all children and adults.

Background

This project seems particularly timely in view of recent studies on the state of the Alaskan economy (see for example Anchorage Times, December 15, 1982, p. B-4; Report of the Roundtable Discussion on Alaska's Fiscal Future, November 19, 1982, Council on Economic Policy). Specifically, the dependence of the State's economy upon the expenditure of State funds which are tied to oil revenues is being recognized. These revenues are expected to be on the decline in future years, and this should have a profound effect on the State's ability to pump funds into the economy. This would suggest that for practical reasons the State should make every effort to capitalize on initiatives begun during the period of favorable funding. One of these initiatives has been in educational computing. The Alaska Department of Education, in cooperation with the National Institute of Education and on its own has been steadily improving the climate and quality of education in Alaska, relying heavily on technology such as telecommunications satellites, and computers. This has resulted in a number of projects in educational technology such as the Educational Telecommunications for Alaska (ETA) project which utilizes data bases, computers, and telecommunications to

improve educational services, the Individualized Study by Technology (IST) project which allows previously unavailable courses at the secondary level to be offered for individual study in rural areas, or for flexible programming within a school, and the Electronic Mail System (EMS) that now provides timely transfer of printed communications among schools and educational agencies.

These pioneering initiatives have put Alaska in the forefront of educational computing with a relatively computer-literate base of personnel and students in the schools. Given the need for an alternative economic base besides oil, the needed services technology has started to bring to Alaska, and the computer sophistication of trading nations in the Pacific area such as Japan and Taiwan, it would seem worthwhile to exploit these initiatives and advantages the State now enjoys.

Literature Review

A lengthy review of the literature was conducted. Approximately 110 items were considered including books, articles, existing computer literacy programs offered by publishers, and guidelines of State Departments of Education and Federal agencies. (A complete bibliography is included in Appendix C of this report.) This review revealed three different emphases to computer literacy:

1) Computer literacy is gained through learning programming

2) Computer literacy is gained by working on computers using applications programming (e.g., word processing, participation in computerized instruction, or doing bookkeeping on a computer)

3) Computer literacy is gained by studying the social, economic, and psychological impact of computers on home, family, world of work, government, and society.

Each of these approaches suggested a unique kind of definition of computer literacy. The elements of computer literacy definitions were:

1) Ability to operate a computer
2) Ability to understand a computer's capabilities
3) Knowledge of how to determine when use of a computer is appropriate
4) Understanding of the impact of computers.

(Several sample definitions gleaned from the literature are in Appendix F.)

Existing computer literacy programs universally begin in the early grades, usually kindergarten. The programs might be implemented separately from other educational programs of the school, or become integrated with other programs. For example, creative writing may be integrated with word processing, spelling taught and tested by computer, and math and science "experienced" on the computer through simulation of experimentation or practice exercises coordinated with traditional textbook readings and classroom sessions.

Computers appear to be gaining prominence in all aspects of society and life. However, one of the most prominent areas of growth in computer use is education. According to the National Center on Educational Statistics, the presence of microcomputers is increasing at the current rate of about 50% per year (report dated September 7, 1982, on Instructional Use of Computers in Schools). In comparison, the level of use in Alaska has increased more rapidly than that. In the IST program alone, Apple II computers were used at seven sites for two courses during the 1979-80 school year. By 1981-82, use had increased to over 100 sites with six courses. In 1982-83, eight of these courses are being used widely throughout the State. Currently, it is estimated that there are between 1,000 and 1,200 microcomputers used in the Alaskan schools. If this estimate is correct, then Alaska has about 8% of the micro-

computers currently used in educational settings in the U.S. This is a larger number than would be expected given that the State has about 1% of the students who used computers in schools in the U.S. in 1981-82. Despite these impressive figures, Alaska still has only about 1 computer for educational purposes for every 75 students.

Few states currently have completed state-level standards for K - 12 computer literacy for children and adults. Given the dynamic situation of the technology, it is not clear whether definite, rigid standards are advisable at this time. It is probably preferable to develop a flexible plan that can be adjusted to conditions as necessary. Minnesota has been a leader in computer literacy training. New York has adopted guidelines for computer literacy. Although these programs were considered in preparing the present report, the local conditions and relatively advanced state of computer literacy in Alaskan schools suggest the need for a State plan to further improve training in this area, while remaining flexible and adaptable to local conditions and the changing technology.

Survey of the Status of Computer Literacy in Alaska

In order to determine the status of computer literacy offerings in the schools of Alaska, a telephone survey was done which included respondents from every school district in Alaska according to their approximate proportion of the State's population. A structured questionnaire was used to determine directly which components of what is typically considered to be computer literacy are offered to students and adults in Alaska, and to determine the priority educators would place on this information (see Appendix D). The priority ratings had the following meaning: HIGH PRIORITY was similar to English, science, math and other regular subjects; MEDIUM

PRIORITY was equal to shop, home economics, music, art and other similar subjects. A LOW PRIORITY meant that no emphasis should be placed on that subject.

The responses of 140 educators were obtained. Figure 1 summarizes the results. (A more complete summary was provided DOE in a separate report entitled "The Status of Computer Literacy Training: A Survey of the Schools in Alaska, December 1982." This report includes a breakdown by rural city, REAA, and urban city.)

In addition, public responses to the survey questions were solicited during the mid-December meeting in Anchorage. An additional 34 responses were received. However, this represented only two-thirds of the conference attendees. Further, this group seemed to have a relatively high rate of computer users. For this reason, the group of public conference attendees who responded to the survey are not considered to be as representative of the situation in the State as the more carefully designed sample used in the survey. Yet, the responses of the two groups were rather similar. In the write-up that follows, some of these similarities and differences are highlighted.

Greater than 50% of both groups of respondents (telephone and public meeting) reported their schools were providing instruction in general knowledge and general applications of computers, programming, and hardware and software. Less than 50% of both school persons and public reported their schools were providing instruction in industrial and vocational uses, home uses and research uses. All aspects of computer literacy except home use were rated at least medium priority by both groups. In addition, respondents reported that computer literacy training is available in their school districts (e.g., 63.6% for students and 51.4% for adults among the school personnel, and 62.1%

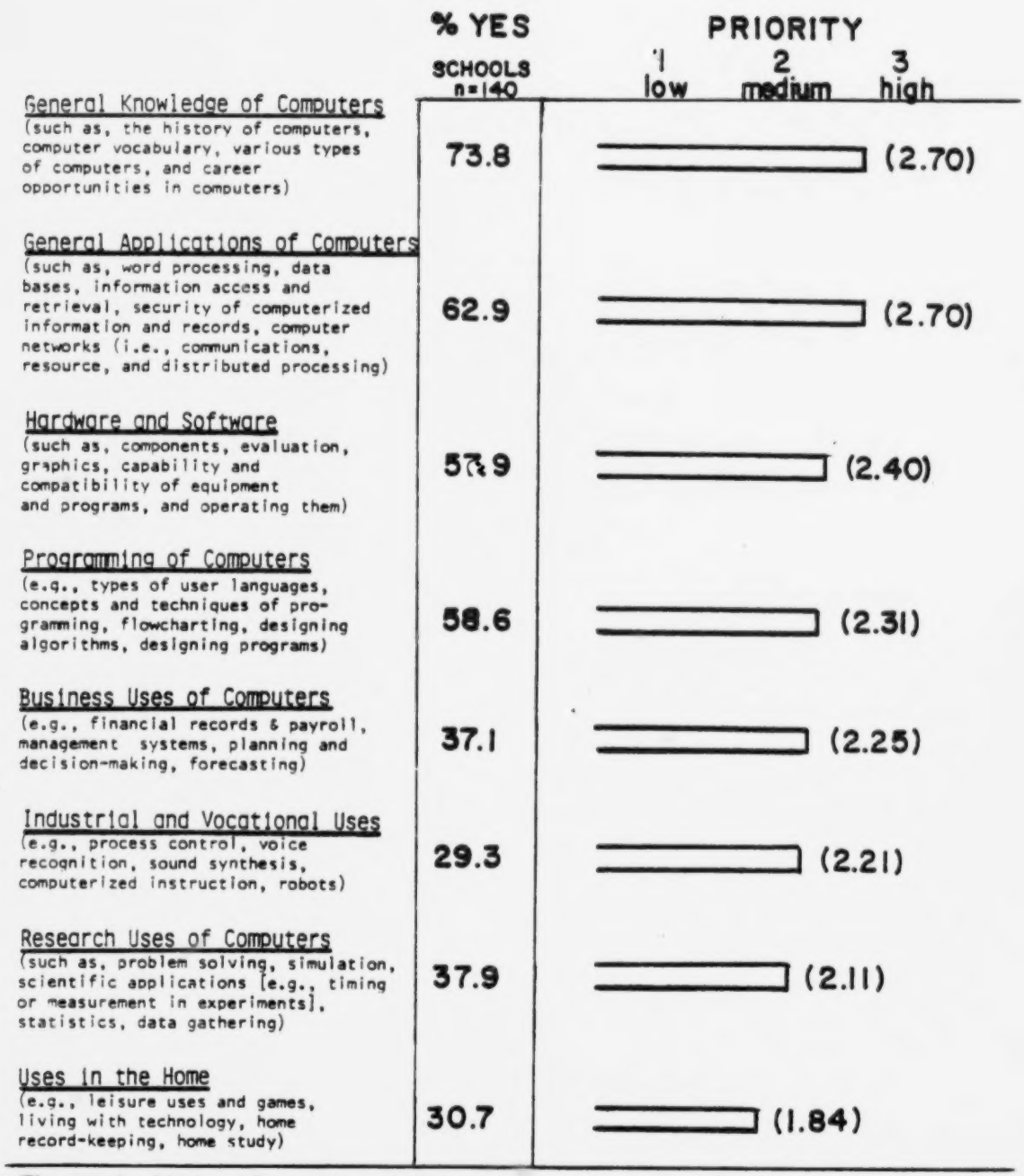
% YES
SCHOOLS
n=140
PRIORITY
1 low
2 medium
3 high
General Knowledge of Computers
(such as, the history of computers, computer vocabulary, various types of computers, and career opportunities in computers)
73.8
(2.70)
General Applications of Computers
(such as, word processing, data bases, information access and retrieval, security of computerized information and records, computer networks (i.e., communications, resource, and distributed processing)
62.9
(2.70)
Hardware and Software
(such as, components, evaluation, graphics, capability and compatibility of equipment and programs, and operating them)
57.9
(2.40)
Programming of Computers
(e.g., types of user languages, concepts and techniques of programming, flowcharting, designing algorithms, designing programs)
58.6
(2.31)
Business Uses of Computers
(e.g., financial records & payroll, management systems, planning and decision-making, forecasting)
37.1
(2.25)
Industrial and Vocational Uses
(e.g., process control, voice recognition, sound synthesis, computerized instruction, robots)
29.3
(2.21)
Research Uses of Computers
(such as, problem solving, simulation, scientific applications [e.g., timing or measurement in experiments], statistics, data gathering)
37.9
(2.11)
Uses in the Home
(e.g., leisure uses and games, living with technology, home record-keeping, home study)
30.7
(1.84)

Figure 1. Major Results of Computer Literacy Telephone Survey

(MEAN PRIORITY RATINGS ARE SHOWN IN PARENTHESES AT THE TOP OF THE BAR EACH REPRESENTS IN THE GRAPH)

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for students and 39.3% for adults among the public meeting respondents). Often the adult training is offered at the community college. About 3/4 of both groups felt that at least part of the computer literacy offerings should be integrated with other subjects in the regular school curriculum. Further, 65% of the school and 80% of the public respondents were regular users of computers at home, at work, or both, suggesting a high rate of computer literacy among respondents. This was supported by the fact that among those who used computers, 25% of the school and 50% of the public respondents did their own programming.

Summary of results:

1) All school districts in the State contributed to the results.

2) The public who attended the meeting and responded to the survey were less interested in seeing general knowledge about computers such as history, types of computers, etc. in the program than they were in more practical training (i.e., word processing, data bases, etc.).

3) Respondents from the rural cities and REAA districts tended to respond more like each other than like their colleagues from the more urban areas and had more fully developed computer literacy programs.

4) Urban school personnel tended to attach a lower priority to computer literacy than their colleagues in rural cities and REAAs.

5) Industrial and business applications of computers were rated as a higher priority by rural than by urban respondents.

6) Programming and general applications of computers such as word processing and data base uses were given high priority, while home uses were rated considerably lower in priority as components of computer literacy programs.

7) Greatest priority overall was given to general knowledge (history, vocabulary, type of computers, career opportunities). However, this was not given as high a priority by those respondents attending the public meeting.

8) More than half of the respondents used computers at work, but most computer users in the schools do not write their own software.

9) Most respondents tended to favor integrating computers into the regular curriculum rather than treating it as a separate subject.

10) Computer literacy programs were most common in rural city districts than in others.

11) Although computer applications in business and industry were given relatively high priorities, especially by rural city and REAA respondents, they were not currently being taught in many locations.

Major conclusions resulting from the survey:

1) More of the computer literacy programs in urban areas are just beginning or are at a starting entry level than is true in the rural areas. This suggests the need for a multi-level computer literacy program initially emphasizing entry skills in urban areas.

2) Overall, Alaska has an excellent level of computer literacy among its professional educators when compared to other states, and this should continue to provide an outstanding basis for improving computer literacy within the State. This edge should be exploited by continued efforts through the Department of Education focusing on technology education.

3) Industrial and business aspects of computer literacy require greater attention from DOE.

The Three-Day Conference

A three-day conference with the purpose of planning computer literacy training in the State of Alaska was held in Anchorage December 13-15, 1982. Twenty-two panel members were selected to provide a group with diverse perspectives toward the topic of computer literacy. The group included representatives of rural and urban schools, business and industry, government, the private sector, and students from various regions and locations within Alaska.

The first day of the conference was open to the public and was attended by over 60 persons. In this General Session, two keynote speakers, Andrew Molnar of the National Science Foundation, Office of Science and Engineering Personnel and Education, and Joseph Deken, a professor in the School of Business, University of Texas at Austin, and author of the widely-acclaimed book, The Electronic Cottage, presented papers which focused on the topics of occupational literacy and citizen literacy in computers. A videotape of an internationally televised teleconference produced by the Dean's Network, Ohio State University, which reviewed efforts at development of computer literacy in the U.S. and Canada was also shown.

Dr. Molnar, speaking primarily about the vocational and technical aspects of computer literacy, pointed out that computers are becoming extremely common in such a diverse range of applications that they cannot be ignored in the educational process. He further noted that the world economy was much more complex, and that countries' economies were more inter-related than they have been in the past. In this environment, trading partners and competitors have been investing heavily in getting ready for the role of computers in manufacturing, business, and trade. This includes investment of funds for educational programs for students

and adult citizens in computer literacy. A recent NSF study found that computers were pervasive in all parts of society except education, and that education was not only missing an opportunity, but failing to discharge its responsibility. According to Dr. Molnar, the notion of a literate person is changing from one who knows information to one who knows how to find information. He highlighted society's increasing need for technically trained persons in the job market. For example, in the near future one who uses a drill press probably will find programming of the control system (e.g., computer-controlled robotic device) a more important skill than knowing how to actually operate the drill press. Finally, he urged doing more than simply adding computers to the classroom. He felt an educated person living in the modern society will have to understand the computer, its uses, and its effects on society. (See Appendix A for a summarized text of Dr. Molnar's presentation.)

Joseph Deken's presentation focused more on the role of computers in the society of the future. He questioned whether computer literacy should be considered in the same vein as mathematics and language literacy. Dr. Deken strongly emphasized the need for networking of computers (computers talking to each other), and whether the stand-alone microcomputer was really the best device for classroom use of computing. He stressed the need for a dynamic definition of computer literacy to compensate for the rapid changes that occur in the technology. He also emphasized the role of on-going teacher training in this area. Dr. Deken saw the major role of Departments of Education in the area of computer literacy as facilitating communication between teachers, teachers and computers, teachers and training institutions, etc. Further, he focused on the expanded role computers are beginning to play in everyday life. (See Appendix B for a summarized text of Dr. Deken's presentation.)

The videotaped segment from the program aired by the Dean's Network at Ohio State University emphasized a number of considerations for implementing a computer literacy program. Among them were user evaluation of hardware and software, use in the classroom integrated with other academic subjects, introduction of computer literacy at lower grade levels, involvement of teachers and staff in the planning process, need for administrative support, teacher-training requirements, social and institutional impact of computers, and other related topics. It provided a concise introduction to numerous aspects of computer literacy by several experts from the U.S. and Canada.

The final activity on the first day provided an opportunity for input from those attending the General Session. A survey form, similar to the one used in the statewide phone survey, was distributed which requested response to whether respondents thought aspects of computer literacy were currently being provided in the schools, and what sort of priority should be given to these aspects by the Department of Education. These survey results were tabulated and were prepared for distribution and discussion the next day in the small group workshops.

During the second and third days of the conference participants met in separate groups of about twelve to discuss citizen literacy and vocational/occupational literacy (see Appendix E for List of Group Participants). Among the topics discussed in these two areas were definitions, goals and objectives, topics for instruction, teacher and administrator training, and a timetable for implementation (see Appendix F for the Meeting Agenda). These discussions were influenced by the literature review and the survey results.

III. REPORT OF THE WORKGROUP ON COMPUTER LITERACY FOR CITIZENS

The group met for two days of intensive discussion on the 14th and 15th of December 1982. The meetings focused on the necessity of providing an Alaskan citizenry that is computer literate. This would enable Alaska to move into a broader-based, technology-oriented economy in the coming years. This transition was seen by the workgroup as an economic necessity for a state which faces rapidly depleting resources and a highly dispersed population.

Various reading materials, statements of experts, the presentations of the open meetings on December 13th, the experiences of the panelists, the survey of computer literacy status, and the economic situation of the State were major concerns in formulating the position statement presented in the following pages. The major background considerations are as follows:

1) About 1/2 to 2/3 of the schools in Alaska offer some kind of computer literacy training to students and/or adults presently. The group felt that this reflects the outstanding record of the Department of Education, particularly the Office of Educational Technology and Telecommunications, and its Educational Technology for Alaska (ETA) project in fostering educational computing in Alaska. However, there are no standards of training or recommended course content in this area. Further, according to the survey, computer literacy is not as advanced in the urban as in the rural city and REAA areas.

2) Alaska will require a computer literate population if it is to participate in the high technology world of the present and near future.

3) According to the November 1982 survey done by Interwest Applied Research, Inc. of educational computing in Alaska, it appears that there is great interest in expanding educational computing.

In the near future, it is expected that educational programs will place a greater emphasis on the ability to locate information from large

complex data bases. Thus, educational programs will not only focus on knowledge, but how to access it. With this in mind, the citizen literacy group initially considered the definition of computer literacy, then moved to goals and objectives, topics of instruction, training requirements for teachers and administrators, and a recommended timetable for implementation.

Definition of Citizen Computer Literacy

> Computer literacy for the State of Alaska means developing all of our human resources in an information and communications-based society. A society that fosters computer literacy is one that affords its citizens opportunities to acquire computer literacy skills, knowledge, and attitudes appropriate to individual needs.

In this definition, computer literacy is seen as a component of the ability of the citizens in the State to participate and compete in the emerging technological society. It emphasizes development of human resources. Further, it relates technical literacy to the other more traditional literacies of reading, writing, and speaking by emphasizing skills, knowledge, and attitudes.

Goals and Objectives

The group identified five broad objectives for computer literacy planning. These objectives were guided by the following overall goal: to develop an informed citizenry capable of exploiting new opportunities and participating in societal decisions related to computers and technology in modern society. The five broad objectives are specified below, with the major topics of instruction that were identified for each.

1.0 Possess operational computer skills

The presence of computers in society has been increasing at unprecedented rates. In schools alone, it has been estimated that the numbers of computers in classrooms have gone from 102,000 in the 1981-82 academic year to 156,000 at the start of the 1982-83 school year (according to figures from the National Center for Educational Statistics). Further, it has been estimated that by 1990 virtually all occupations will involve computers in one way or another. Finally, the entry of computers into the home has already started. At first they were primarily used for games and entertainment. However, they are now part of home appliances such as ovens, refrigerators, and washing machines, and a person's level of participation in all aspects of society is rapidly becoming dependent on his or her ability with, and awareness of, computers.

Topics of Instruction:

1.1 Knowledge of Computer Components

This includes the major hardware components, such as the central processor, disk drives, modems, printers, CRTs and other peripherals, as well as such major internal components as RAM, ROM, and CPU. In addition, it includes such major software components as languages, operating systems, and applications programs. At this level, the student would be expected to know about these elements.

1.2 Operation of Computer Systems

This topic would cover the operation of the hardware and software components of the computer system.

2.0 Understand and make effective use of current and emerging roles of computers in modern society

This goal was meant to be active and dynamic in nature. Active in that citizens should be capable of using computers effectively, rather than passively allowing an elite few who are able to design and program computers determine who shall use them and how they shall be used. The goal is dynamic in that it recognizes the roles of computers in society are changing.

Topics of Instruction:

2.1 Educational Applications

Covers the various ways that computers can be used for education in school, home and the workplace.

2.2 Vocational Applications

Includes applications for training, control, business and office, manufacturing, trade, and other forms of applications in the workplace.

2.3 Personal Applications

Includes all applications in the home for convenience, leisure, entertainment, information access, and communication.

3.0 Understand the ethical and social issues related to current and emerging roles of computers in modern society

This objective focuses on such issues as impact on jobs, security of personal information, and effects on the social, psychological and physical well-being of people as computers' influence and pervasiveness increases.

Topics of Instruction:

3.1 Privacy and Security

This includes privacy and security of data bases and information, and the human considerations inherent in these issues.

3.2 World of Work

The changing workplace, the dynamic nature of occupations, the emergence of new occupations would be covered here. Society's responsibility for continuously retraining the workforce to meet its needs, and the dynamic effect of this on employment would be considered.

3.3 Social Interactions

The various ways that computers can affect interactions between people would be studied. This would include effects on social groups, recreational groups, etc.

3.4 Personal Interactions

The focus here is on improving communication in the family and with the individual.

4.0 Evaluate the advantages and disadvantages of various computer applications

This goal emphasizes the need to know when to use computers, including consumer skills and how to determine relative advantages and disadvantages of hardware and software applications.

Topics of Instruction:

4.1 Identification of Appropriate Computer Uses

Covers such topics of computer use as speed, precision, and matching computer applications to individual needs.

4.2 What To Use For Specific Applications

Includes evaluation techniques for hardware and software.

5.0 Participate in decisions related to the application of computer-based technology in their personal lives in modern society

The fifth goal stresses the need for citizens who are actively (rather than passively) involved in the technology movement, and can help determine its effects on their lives.

Topics of Instruction:

5.1 Knowledge of Current Issues

This includes social, political, and economic as well as technological issues.

5.2 History of Technology

In order to understand the present impact of technology, one must be able to look at it in terms of its effects in the past.

5.3 Personal Decision-Making

Relates to the decisions one makes in one's life with which computers may assist or how they may help in attainment of personal goals and objectives.

5.4 Societal Decision-Making

This addresses the political and economic realities of Alaska, and the citizen's role in affecting decision-making about technology and computers within those realities.

Teacher and Administrator Training

Although teachers and administrators must necessarily be involved in offering improved computer literacy education, it cannot be assumed that they have the knowledge to do so. For this reason, teacher and administrator training would be an important part of this effort. The Department of Education has had the foresight to establish programs and initiatives designed to improve teacher and administrator literacy; among these efforts have been regional workshops for teachers, on-site training at local schools, manuals for the Individualized Study by Technology (IST) program, the Minnesota Educational Consortium for Computers (MECC) materials, and the ETA Newsletter. They have also been cooperating with the community colleges and Alaska Association of Computer Educators to offer timely seminars and training for teachers and administrators. The workgroup recommended continuing these efforts with ongoing upgrading of this training so that it can keep pace with changing technology. This recommendation covered four broad areas described below.

1) Organizations to be involved

The group recommended that training be provided primarily by a coordinated effort of the Department of Education, the University of Alaska system, the Community College system, and the school districts. Outside consultants should be utilized in situations where the quality of expertise within the State is not sufficient.

2) Modes of delivery

It was recommended that a variety of delivery patterns be utilized to offer training to teachers and administrators during the academic year and in the summers. These might include summer workshops, in-service workshops held on a district or regional basis, newsletter articles, and commercially prepared packages offered through Regional Resource Centers, libraries, the Department of Education or other outlets. Computer training affords a good opportunity for the Department of Education and the University system to cooperate by offering courses for graduate or continuing education credit.

3) Content of training

Topics that should be included in a training program for teachers and administrators are:

a) How to teach computing

b) Classroom management in an environment that contains computers

c) The instructional value of computer presentations

d) That teachers and administrators should be willing to experiment with computer applications

e) Familiarity with computers and components initially, followed by specialized topics (e.g., spreadsheet applications in science teaching, or word processing in creative writing).

4) Certification

Finally, it strongly recommended that:

a) DOE establish standards for all inservice, summer, continuing education and commercial programs and emphasize their evaluation

b) No add-on certification standards be proposed for teachers currently holding valid teaching certificates;

these teachers should be encouraged to participate in the inservice and other kinds of training that is offered to help teachers become computer literate

c) DOE work with the University system to build computer literacy into the teacher-training programs.

TIMETABLE

The following timetable was recommended for implementation of a computer literacy effort:

1)	Training for teacher trainers available on an ongoing basis through the DOE, University of Alaska system, community colleges, and school districts	On continuing basis from present
2)	Activities by DOE, University of Alaska system, school districts and community colleges coordinated to continue ongoing development of trainers who can help teachers to improve their computer literacy	January 1984
3)	Resource bank established by DOE of teachers and administrators with expertise in computers who might offer training	February 1984
4)	DOE coordinate activities by U of A, community colleges and schools to develop computer literacy guidelines for students and adults	July 1984
5)	Seed grant program established for stimulating local and regional computer literacy centers for adults	July 1984
6)	75% of teachers and administrators are computer literate at an introductory level	June 1985

IV. REPORT OF THE WORKGROUP ON VOCATIONAL COMPUTER LITERACY

This group also met for approximately two days of discussion on December 14 and 15, 1982. Initially, the workgroup was apprised of the major trends in business computing by its members from the business community, Mr. Richard Barnhart, Vice President of the National Bank of Alaska and Mr. Jack Jesse, Senior Marketing Representative for the IBM Corporation:

1) A rapid decentralization from a situation in which one or more large computers process data overnight to the use of multiple workstations and multiple computers is taking place.

2) The trend is away from printed reports to the use of video screens to convey information. Therefore, all employees need to be instructed in how to use computers to solve their business problems, and cured of their fear of computers.

3) There is increased use of microcomputers which can do limited kinds of calculations and other functions using available commercial software. Microcomputers are becoming particularly popular because of the long backlog of requests for programs to be written for the large mainframe computers. In the future, links between the microcomputers and the large central systems will take place and allow the microcomputers to get data from a large central system and then use this information in their own calculations and processing.

4) There is presently a great increase in the number of employees using computers. The banking industry has approximately one workstation for every two employees today, while the Alaska State government has one computer workstation for every four employees. Both groups are moving rapidly to one computer workstation per employee.

Definition of Vocational Computer Literacy

The workgroup defined vocational training as any program that leads to an entry level job. It reviewed five definitions of computer literacy offered by such authors as Hunter, Moursund, Rawitsch, Leuhrmann, and Anderson and Klassen (see Appendix F). These definitions vary from lists

of specific skills to emphasizing the ability to control the computer. After careful considerations and considerable discussion, the group adopted the following definition:

> Vocational computer literacy is a functional/ operational knowledge of computers and their applications in the modern work environment. This competency should be at a level compatible with other knowledge and skills a person has acquired.

Computer Use in Society

The group next considered the ways in which computers are used in various social roles and occupations. Table 1 presents the six levels that were distinguished by the group in computer sophistication. At level 1, one is aware of computers, knows some of their history and concepts, and has had a hands-on experience which made one comfortable and confident in using the computer. The workgroup felt that this level of sophistication would be needed by all citizens of the State of Alaska in the future.

Level 2 is an entry level use in which computer applications designed by other people are activated by the person in his or her social role or occupation. A prominent example of this is the use by cashiers of computerized cash registers. The third level of computer use involves those occupations in which the computer is available as a tool to do certain jobs such as in accounting or in word processing.

A fourth level of computer sophistication involves employing a computer as a tool to create a tool. For example, in engineering and architecture, a computerized model of a situation is developed and then used to design, test, and create certain products.

Table 1

Levels of Computer Sophistication in Social Roles or Occupations

Levels	Descriptions
1. Computer Awareness	Needed by all citizens (e.g., history, concepts, hands-on)
2. Entry Level Use	Use computer applications designed by other people (e.g., data entry clerk, cashier)
3. Computer Use	Use computer as available tool to do job (e.g., spreadsheet accounting, word processing)
4. Computer Creation	Employ computer as tool to create a tool (e.g., engineering, architecture, modeling)
5. Data Processing	Help other people do their job with computer (e.g., systems analyst, programmer)
6. Computer Systems Development	Design hardware and software for computer systems (e.g., software vendor, systems engineer, systems programmer)

The fifth level of sophistication in the use of the computer is data processing in which people specialize in helping other people use the computer to solve their problems and in maintaining large central systems or decentralized programs.

The highest level of sophistication in using computers involves those occupations that actually design computer systems, hardware, and software for computer companies.

It was felt that Alaska has needs for the development of the first five levels of computer sophistication in its workforce, but it is unlikely that in the near future it would be the headquarters for the development of new computer systems and, therefore, will not need personnel at the sixth level of sophistication.

Educational Programs Needed

The workgroup next considered educational programs that would be needed to raise the citizens of Alaska through the fifth level of sophistication in computers. After much consideration, five major educational programs were distinguished and these will be described in turn:

1.0 Make all citizens comfortable and confident with computers

It was the opinion of the panel that all citizens of the State of Alaska will need to be aware of computers, their history and important concepts, and be comfortable in working with them. Yet it was reported by both the industrial and educational representatives in the group that there is widespread anxiety and fear of these new tools.

Types of Students:

1.1 Adults

Large numbers of adult citizens need to have computers demystified, to have hands-on experience with them in order that they will be comfortable and confident in using them in their occupations. An educational program to develop this important attitude needs to be provided to all citizens, whether presently enrolled in educational programs or not. The program would be remedial for adults. It would emphasize hands-on, participatory experience with computers.

1.2 Presently enrolled students

For those students presently enrolled in elementary school or higher levels of education, the immediate development of integrated use of computers in their curricula is needed to provide them with the necessary attitudes and skills.

2.0 Provide information about computer careers

It is important that all citizens of the State of Alaska be aware of the opportunities available to them occupationally through the use of computers. This is true for those citizens who may be aware only of how computers function in society to those who would be the most sophisticated users of them. The group felt that in general this need was presently being met by the Alaskan Career Information System (AKCIS) and that its continued availability to all citizens of Alaska was very important.

3.0 Develop computer literacy at an employable level in all fields

It is important that the citizens of Alaska develop computer skills at a level in which they will be useful in their particular specialty or occupation. The teaching of these skills should be in a manner that is integrated within the particular field. Examples of attempts to do this were given by the group from areas as diverse as nursing and accounting. The group felt strongly that these efforts should be continued and increased. On the other hand, they cited examples where students were trained at career centers as programmers but do not have the skills needed to work in industry at that level and are hired often as computer operators. For this reason, Alaska needs to strongly encourage the use of computers as tools in all educational enterprises: uniform experiences at lower educational levels and specialized computer activites in the advanced stages of education. The skills gained from these experiences should be at a level that is useful in the world of work.

Types of Students:

3.1 Employment levels 2 and 3

Courses presently taught in Alaska in the area of computers primarily involve programming. Yet, occupations that involve computer sophistication at levels 2 and 3 do not require programming. Word processing and spreadsheet applications involve learning a set of program language-like commands to control the program. For occupations at levels 2 and 3, students need instruction in what might

be called metagramming, the skills involved in operating these programs, rather than specifically in programming a computer.

3.2 Employment levels 2 through 6

In addition, students need to learn how to use the computer to problem-solve and how to evaluate the advantages and limits of different computer uses. This will be useful for all employment levels from 2 through 6.

3.3 Rural

There are few vocational training courses leading to skills at an employable level available to students enrolled in small, non-urban schools. For these students, the development of computer-assisted vocational training courses following the Individualized Study by Technology (IST) model is urged.

4.0 Allow for communication and information access with computers

One of the major uses of computers outlined by one of the keynote speakers, Dr. Deken, is as a communications tool--a way of keeping in touch with other people. This happens via a computer network which is a collection of computers and terminals at different sites interconnected by a communications satellite. The group felt this was a particularly important computer use for a state like Alaska where the population is widely dispersed. The group pointed out that there are now a half a dozen or more computerized networks of proven benefit in the State of Alaska serving various specialized

needs. National networks such as Timenet, Timeshare, MECC, etc. have also shown that networks can work. While there are a number of networks existing in Alaska, they do not communicate with each other nor do they reach all remote areas of the State, and many of them do not carry all the kinds of data networks are capable of transporting.

A system is needed to deliver educational programs to all parts of the State of Alaska. Because of this, the group urged the integration and upgrading of the existing networks to make them more accessible and comprehensive. It urged the State to develop a statewide public information and communications network funded by the State and accessible from any telephone in Alaska to unite existing networks and make them available to all citizens. This network would allow for both information access and communication between the widely dispersed citizens of the State. Students interacting with this network would learn conferencing skills and the importance of privacy and security in dealing with computer files. It is very important that this network be formed as soon as possible because the cost of combining the growing Alaska networks into one overriding network will increase as time elapses. Industrial representatives in the workgroup indicated this kind of network can be done with existing technology. The group recommended that the planning for this network begin immediately, and that a planning group be designated for developing this statewide network and that the process begin as soon as possible.

Important Network Characteristics:

4.1 The network should be like a public library--free and available to all citizens

4.2 Both voice and data transmitting and receiving capabilities and, as soon as possible, video transmitting and receiving capabilities should be installed at all sites in the State

4.3 The network needs an information manager or network control person or unit

4.4 The network should include a software clearinghouse

4.5 The network should include a hardware clearinghouse

4.6 The network should contain a career information bank

4.7 Point-to-point electronic mail service should be available through the network

4.8 A software bank which can send and receive programs as well as files should be established

4.9 Computer conferencing capabilities need to be available

4.10 A window to other networks in the lower 48 should be part of the network which will allow communication with networks such as Timenet

4.11 The network should be flexible so that all types of equipment can be used on it along with a variety of software

4.12 The network should be flexible, allowing for future change and growth

4.13 The network needs to have mainframe computer power

4.14 The network should be accessible from a microcomputer

4.15 The network needs to go into every school in the State

4.16 The network should contain data bases like The Source

4.17 Expert locating and consulting services should be available through the network

5.0 Teach systems analysis and programming

While the group realized that Alaska would not be the originator of computer systems, it recognized the need for trained personnel at levels 4 and 5 of computer sophistication for many of the industries presently in the State. The representatives from industry were particularly strong in pointing out the need for developing people at these levels of sophistication. They estimated that industry in the State can absorb hundreds of systems analysts and programmers per year in the immediate future, and that the State government will need additional large numbers of these people. Very few of them are produced in the State, requiring nationwide recrutiment of these personnel for Alaskan industries. Because of the high turnover rate in the population of the State, recruitment is a continuous effort. Therefore, the workgroup urged that the permanent population be trained to satisfy some of these manpower needs.

Existing programs in the State of Alaska fail to provide employable level skills needed in the world of work. Therefore, the panel urged that a five-year program be created at the university level with a one-year internship to develop systems analysts and programmers from the permanent population of the State of Alaska. The graduates of this program would be at the 5th level of computer sophistication, and specialists in tending management information systems.

Summary of Educational Programs and Occupation Levels

Table 2 presents a summary of the five educational programs recommended by the Vocational Computer Literacy Planning Workgroup as they apply to occupations requiring different levels of computer sophistication. It was

Table 2

Educational Programs Needed for Different Occupational Levels

Educational Programs Needed		Levels of-Computer Sophisticatin in Occupations					
		1	2	3	4	5	6
		Citizen Awareness	Use Applications	Use as Tool	Computer Creative	Data Processing	Systems Development
1.0	Make all citizens comfortable and confident with computers	X	X	X	X	X	X
2.0	Provide information about computer careers	X	X	X	X	X	X
3.0	Develop computer literacy at employable level in all fields		X	X	X	X	X
4.0	Allow for communication and information access with computers			X	X	X	X
5.0	Teach systems analysis and programming				X	X	X

felt that all citizens need to enroll in educational programs 1.0 and 2.0 providing a comfortable and confident attitude towards computers and career information. Educational program 3.0 involving computer literacy in an occupation or field at an employable level is applicable to all of the occupations involving computer sophistication levels 2 through 6. Educational program 4.0 which instructs citizens in the use of computers for communication and information access is needed for persons entering occupations which use the computer at levels 3 through 6. Finally, educational program 5.0 is directly aimed at producing systems analysts and programmers.

Teacher Training

Several types of personnel need to be trained to staff the proposed educational programs:

1) All teachers

The workgroup agreed that all teachers in the State of Alaska need training in computers. It is important that they all receive educational program 1.0 to make them comfortable, knowledgeable and confident with computers. All teachers should have knowledge of computers equal to their capability in other areas consistent with the definition of vocational computer literacy.

2) District computer consultants

More specialized teachers also need to be trained or hired. Each district should have a computer consultant of some kind.

3) Certification of teachers of data processing

Certification to teach data processing at individual schools should be evaluated. The group felt that the present certification process is very inadequate and needs to be examined.

4) University faculty

For educational program 5.0, dealing with systems analysts and programmers, Alaska needs to hire faculty at the university level badly. In addition, for educational program 3.0, additional faculty need to be hired that know how to integrate computers into their fields and specialties.

5) Advisory committee

A business advisory committee needs to be created to advise vocational education programs on the kind of computer experiences that should be offered.

Summer programs were a method of delivery of training that was supported by the group. Facilities often are not used in schools during the summer, and computer camps or schools can be set up. Teachers can be trained at the same time and can serve as instructors to the students at the summer camps. By setting up these special programs, the State may be able to make considerable progress in a short period of time in developing teacher and student computer literacy.

II. RECOMMENDATIONS

The workgroup on citizen computer literacy recommended the following definition of computer literacy:

> Computer literacy for the State of Alaska means developing all of our human resources in an information and communications-based society. A society that fosters computer literacy is one that affords its citizens opportunities to acquire computer literacy skills, knowledge, and attitudes appropriate to individual needs.

This citizenry should:

1.0 Possess operational computer skills

2.0 Understand and make effective use of current and emerging roles of computers in modern society

3.0 Understand the ethical and social issues related to current and emerging roles of computers in modern society

4.0 Evaluate the advantages and disadvantages of various computer applications

5.0 Participate in decisions related to the application of computer-based technology in their personal lives in modern society.

In regard to teacher training, the group recommended that training be provided primarily by coordinated efforts of the Department of Education, the University of Alaska system, the community college system, and school districts. A variety of modes of delivery should be utilized to offer training to teachers and administrators. Topics that should be included in the training include how to teach computing, classroom management of computers, and specialized topics in computing which are part of a teacher's field of specialization. Finally, it was strongly recommended that the DOE establish standards for the training, but that no add-on certification standards be proposed for teachers currently holding valid teaching certificates. The DOE

should work with the University system to build computer literacy into existing teacher training programs.

The corporate business community of Alaska is moving rapidly to the decentralization of computing and the use of multiple computer workstations and numerous microcomputers. Video screens are replacing printed reports as conveyors of information, and the trend is towards every employee having a computer workstation. In order to complete the delineation of computer literacy in modern society, the vocational computer literacy group adopted an additional definition of computer literacy:

> Vocational computer literacy is a functional/ operational knowledge of computers and their applications in the modern work environment. This competency should be at a level compatible with other knowledge and skills a person has acquired.

In order to supplement general citizen goals, the vocational computer literacy group recommended five vocational education programs:

1.0 Make all citizens comfortable and confident with computers

2.0 Provide information about computer careers

3.0 Develop computer literacy at employable level in all fields

4.0 Allow for communication and information access with computers

5.0 Teach systems analysis and programming.

The highest priority was given to establishing a statewide public information and communications network funded by the State and accessible from any Alaska telephone. This network would be a collection of computers and terminals at different sites interconnected by a communications satellite. The network would consolidate existing Alaska special networks, and make them

accessible to all citizens. It would allow voice, data and, eventually, video communication among all sites in Alaska. The group felt that the statewide public information and communications network would be a foundation on which teacher training and the development of other educational programs could build, and that planning for this network should start immediately. Next in priority, the group recommended the hiring and training of several types of teachers and administrators for all levels of the State's educational system, elementary through university levels, to staff the recommended educational programs. While these first two steps are being taken, the implementation of educational programs 1.0, 2.0, 3.0 and 5.0 should take place.

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STATEWIDE COMPUTER LITERACY STUDY

APPENDIX TO
FINAL REPORT
- JANUARY 1983 -

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STATEWIDE COMPUTER LITERACY STUDY

Department of Education

Office of Educational
Technology & Telecommunications

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Prepared by: Systems for Training and Applied Research, Inc.

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APPENDIX A

Keynote Address

COMPUTER LITERACY: WHAT NEXT?

Dr. Andrew R. Molnar
National Science Foundation*

*The views are those of the author and do not necessarily represent the views of the National Science Foundation.

COMPUTER LITERACY: WHAT NEXT?

Andrew R. Molnar
National Science Foundation

The Information Age

We have moved into an Information Age which has caused a major social, economic, and structural change in our society. We are deindustrializing our society and economy and are building a new foundation around computers, communications, and information. This is creating a national need for a very large work force who are familiar with science and computer-based skills, but our educational institutions are not keeping pace with these developments and are unlikely to prepare our children for the world in which they are going to live. The social and economic consequences may be that we are producing a whole generation of computer illiterates who are doomed to be an underclass who are permanently unemployed because they cannot effectively function in a computer-based society. What educational policy there is tends to be oriented towards counting computers, rather than making computers count. Merely adding computers to the classroom without restructuring our educational system, revolutionizing our curriculum, and retraining a whole generation of teachers, is more likely to create computer anxiety than computer literacy and productive thinking and problem-solving.

Over the past three decades, we have experienced an enormous information explosion. The world body of scientific and technical information has doubled during the last twelve years. Two million scientific writings are published each year. With this information explosion, we are now experiencing an ignorance explosion. We now know less of what is known and it has become more and more difficult to find information. Nobel Laureate Herbert Simon, says that the meaning of the words "to know" has changed. It used to mean "having in one's head," now it means "being able to have access to it," "to find it," or "to locate it." The discovery of information does us very little good until we get it into the hands of educators and into the hands of ultimate users, students. We need new intellectual tools to help us amplify our memories and to solve the increasingly more complex problems that we encounter in today's information society. This is the challenge that education faces today. It is the new imperative in education--to know how to access and use information. It also can be argued that computers have broadened and in many cases changed the very nature of our educational needs. This has led educators to raise questions about many of the basic assumptions underlying modern education. Many now feel that individuals who are not computer literate and who do not understand how systems work, may be unable to take advantage of these information systems and may become a new "intellectually, socially and economically disadvantaged" group.

Computer discoveries are occurring at a very fantastic rate, and many of these are being converted into applications within our society. Computers can be found on the farm, in industry, in business, in the government, and in the home. Everywhere but in education. The use of computers in education is small. Yet, those who do not know the concepts of computing, how to access data bases, how to use computers, unfortunately, cannot be full participants in this information-based society.

Effect on Economy

More and more, industrialized nations are increasing their standards-of-living by producing high technology products such as semi-conductors, fiber optics, biotechnology, and robotics rather than by producing the older industrial products. Some say that the United States is not adapting as fast as other nations. They point out that our Gross National Product (GNP) is eighth among the industrialized nations, and we are now 14th with regard to life expectancy. Our unemplyment is higher than many industrialized nations. The very knowledge, the very information we are creating through scientific discoveries is not consumed or used in a productive way. The need for an intelligent, computer-literate population to take advantage of these developments is important if we are to improve our social, economic, and political well-being.

Other nations, Japan especially, but also France, Germany, Great Britain, have realized that a high tech information society is far more productive with regard to GNP than that of an industrial society. Other nations have come to recognize, much more readily than we, that human capital is more important than physical capital; that people are their most important resources; and that investment in people through education is a critical component of an information economy.

Research shows that since WWII the greatest contribution to our GNP is the accumulation of knowledge. It has contributed about 40% to the growth of our economy. Another study shows that half of our work force is employed in information technology systems and half of our GNP is derived from these types of activities. In summary, our economy, our national well-being, developments in science, developments in education, are all interrelated. Science-derived technological innovations have significantly increased our GNP, and created new industries and new jobs; computer technology has increased our productivity; this, in turn, has created a demand for new skills and a different type of work force. In the past, we could always assume that if an educational innovation was important, our schools would adopt it eventually. The problem now is that we are in a world competition, and that other nations are already systematically introducing these new information technologies into their schools. Other nations now have national plans to move into the information age. Most, working through centralized educational systems, are introducing computers at all levels of education.

Competition is also beginning within the U.S. as well--at the state and local levels. Many states are trying to attract high tech industries in order to increase revenues. What they are finding is that when they attract these industries, their educational systems are unable to produce the number of talented people needed to run them. A recent study shows that high technology industries now consider the availability of technicians and professionals as the number one criterion for relocation and expansion. It is important to high technology industries that the state's educational systems can produce qualified technicians before an industry will move there. Professionals can be lured by higher salaries, but technicians tend to be resident to a particular area. The beauty of high tech industry is that you do not have to be on rivers and harbors, you do not have to be in an industrial area, you do not need raw resources. The things that you do need are good educational institutions and well-educated people. Clearly, there is an opportunity here, especially for Alaska.

Computers in Schools

Recent computer growth in schools has been quite dramatic. Nationally, we have increased from 52,000 to 120,000 computers and terminals in a year and one-half. The National Center for Educational Statistics found that the number of microcomputers in the schools has almost tripled in the last 18 months. Currently the most frequently taught computer course in the high schools is Computer Literacy. Nationally, schools ranked courseware needs as their greatest problem followed by the need for more computers, qualified teachers, start-up assistance, staff, and community support.

The National Assessment for Educational Progress finds that 62% of the 13-year-olds in this country have used a computer; however, only 23% of them have used it in the school. Of the 17-year-olds, 66% have used a computer; while only 33% have used it in the school. However, one sobering fact is that in our schools, only 5% of the students who used a computer have studied computing for more than a year. Clearly, we have a long way to go when it comes to using computers in schools.

Teacher training is a very serious problem. University computer science departments have not been responsive to the needs of teachers. Universities do not have enough equipment, systems or faculty. Most of our colleges and universities do not offer computing courses for master's or Ph.D. candidates in education. But while universities are slow to change, many school districts are introducing their own computer literacy programs and many in-service programs are beginning. But this also presents a problem: As soon as we train teachers in the use of computers, they leave for better jobs in business and industry. This also is happening in the universities. The best professors and the best students are leaving for business and industry. Faculties in computer science departments and engineering departments have been advertising jobs that they cannot fill, some for as long as three or four years.

What Research Says

With regard to its uses in the school, we can think of the computer as a medium, a tool, and an object to study. A researcher, Dr. James Kulik at the University of Michigan, looked at computer-based instruction in higher education and found that it does improve performance by about ten percentage points in all fields, for all types of students. Also, students develop a more positive attitude toward the subject matter and toward the computer. Most importantly, computer activities cut down time-on-task by about one-third. The effects are even greater in secondary schools. Other studies, including one longitudinal study, found that there were significant improvements, particularly in mathematics.

There are many people who say we do not need computer-assisted instruction; they say it is unimportant. One fact should be noted. A recent study found that the course with the highest enrollment in mathematics in colleges and universities is remedial mathematics. Since most courses in science, such as physics, chemistry, and engineering, assume that the student knows calculus, the effect of this is that our university students get behind, even in their own disciplines. Some say that computer-assisted instruction is drab. But in reality given this type of finding we cannot afford not to incorporate computer-assisted instruction into our programs. We cannot afford to have students graduate

who do not understand the elementary concepts upon which their discipline is based. There is a role for computer-assisted instruction.

The computer as a tool has become extremely important, especially in the sciences. Our educational systems have traditionally underestimated the learning abilities and creativity of children. Very young children can do extremely creative things. Even in the earliest grades they are capable of doing advanced mathematics. Elementary school children can do algebra, geometry, statistics--provided the computer is used as a tool to assist them. The computer offers students new degrees of freedom, more intellectual power and permits them to attack more and more complex problems.

Finally, the computer as an object of study is very important. Clearly, in order to function in society, an individual will have to be able to grasp and understand the use of computers. The blue collar worker can be used as an example: In the near future, a drill press operator on the assembly line will find programming of the control system (i.e., a computer-controlled robotic device) a more important skill than knowing how to actually operate the drill press. In order to meet these future needs, the most appropriate placement of computing education programs is not in universities, but in the elementary/secondary schools. Indeed, today some of the best programs in computing are not in colleges, but in high schools. In some areas, business recruiters literally sit at the high school graduation tables and hire technicians. Since in terms of earnings, it is no longer profitable to go to college, a college education in the near future may no longer be the measure of success that it has been in the past. In business and industry, we are beginning to see a whole new class of worker, a knowledge worker, who must be able to operate independently, who must be able to do problem solving, who must know how to use and apply information. It is to this new group that many high school students who are graduating are going to belong. The knowledge worker has needs that are not met by the curricula offered in traditional vocational and academic programs. In the long run these new curricula needs, the "knowledge curriculum," may be the dominant one in our schools.

Once teachers are provided with computers, will they be able to afford to purchase additional software programs? If teachers are to use computers they must be provided discretionary funds to purchase peripheral equipment, software, and courseware as needed. Audio-visual and book budgets for many schools are sparse.

We are now at a place where computers can revolutionize education. However, we also have a discontinuity. That is, we cannot continue to add computers, just for the sake of adding computers. We must restructure our schools, our curriculum, and our teacher training if we are to meet the challenge of the information society. And it is going to be very difficult for us to let go of what we have been doing. Education is at the stage of knowing what to do, but being afraid to do it. In order to accomplish this transformation we will have to reevaluate our educational institutions and the mechanisms we use to finance them.

What Next? Twenty Ideas to Consider Until the Computer Revolution Comes

I would like to present several examples which I hope will stimulate your thinking about computers in education.

1) Louis Machado of Venezuela is the Minister for the Development of Intelligence, nationwide intelligence. He is the only such Minister in the world. Machado believes that the intelligence capabilities of normal humans

are incompletely developed and that a sensible course would be to help all people to fulfill their potential. "If you look at developed nations," he says "and ask why are they so prosperous, you find that it is due to the educational process." Machado argues that by stimulating the brain by doing creative things at the very early ages, and by continuing them at a very high level, the intellectual level of an entire nation can be improved. He says it is a fundamental right of the human to develop that capacity. Therefore, in Venezuela, students are exposed to critical thinking, brainstorming and creativity at every level of education--in the home, in the classroom, and on television. Reports suggest this plan is having a national impact. The intent is to institutionalize this creative intelligence so that students can effectively participate in a democracy on an even level. In order to do this, I might add, if you wish to create a computer literate nation, you must create a computer culture and develop a critical mass of participants. This is true at the national level or at the state and local level. Therefore, if you wish to set computer literacy as your goal, you should involve anyone and everyone who is interested in computing and try to organize a computer culture.

2) The Communications Workers of America have monitored new technological changes by bringing in experts and futurists to look ahead and asked them to write scenarios of what is going to happen in the next ten years within their industry. Following the idea of anticipatory decision making, they next went to union members and said that the communications industry is going to be completely digital in a number of years, and you may eventually be out of a job. What are you going to do? It is obvious that retraining is going to be necessary. On the basis of these scenarios, union members expressed their desires. The union now knows how to assist its members in reaching goals they want to achieve. So, we now have an important social tool--the anticipatory decision-making process. In an era where technologies, industries and careers have become obsolete overnight, institutions, such as unions, are best advised to consider the next innovation and help prepare its members for it. School boards and teachers' unions might well consider this model. Where will you be in ten years and how can you best train yourself to reach that goal?

3) Leadership is one of the most important problems we face in education. Most of the computer revolution in the U.S. has been a grass roots revolution. There are no leaders, there are a few gurus, a few futurists, but there are no real leaders. The real leaders, if there are any, are the students and parents who use computers at home and the few innovative teachers who are already using computers. This is not true in other countries. Two past presidents of France, one Gaullist, one Socialist, have supported the use of computers in society and have ordered nationwide adoption for the schools. Two prime ministers of Britain from different parties have initiated and supported the only centralized activity in their decentralized school system--computing. How do you involve leaders of a country to recognize that there is something important going on here? Leadership begins at the local level and, more importantly, in the classroom. Teachers can lead by doing. If teachers lead, the community will follow.

4) The Children's Museum of Washington set up a session for Congress--a special hands-on activity. Forty congressmen and senators showed up. They were very impressed with the power of the computer. But these legislators, who must act on very complicated issues regarding technology, were not well-informed about computing. Most had never used a computer, but were anxious to learn. Schools can involve community decision makers to participate in the classroom. This will lead to a better understanding of the problems and opportunities.

5) In Massachusetts, business councils have gotten together with the schools. When teachers were laid off, business retrained the teachers to be programmers. They found that they could do this very quickly. The teachers found they could double their incomes. In schools that are reducing staffs, transition programs originated by school boards could productively reemploy teachers. Communities will be able to attract high quality people necessary for high tech education if they have transition plans to assist teachers to meet changing conditions.

6) The National Science Foundation supports a project, Computertown U.S.A., which involves the whole community. The purpose is to go into the community and organize adults and children to work together on computing. There is a Computertown U.S.A.. Manual. It tells you how to get started, how to raise funds, what to do, how to do it. You can write away and get a Computertown U.S.A. Manual and organize your own community action project. There are a number of marvelous success stories all around the country. The British have also implemented this plan and have set up six Computertowns. One need not work through the schools in order to introduce computer literacy into your community and an informed community can hasten school adoption.

7) Other NSF projects have involved gifted children. It is very interesting that a number of fifth and sixth grade children score as high as 650 on SAT (Scholastic Aptitude Test) math tests and some even as high as 750 out of a possible 800. Early identification of these children is extremely important because resources from all segments of the community tend to flow to them once their potential has been identified. Many of these children have entered into accelerated and advanced computer training courses taught at facilities operated by business, industry and universities. These courses are usually taught on weekends at universities, in laboratories, or in business offices. There is a program at Johns Hopkins where young bright children can take accelerated courses during the summer and gain early admission to college. There need to be early identification programs, not only for the talented who plan to go into academia, but for those whose main joy is in problem solving, who want to go out and get jobs in the information world, the future "knowledge workers."

8) Professional organizations such as the Association for Computing Machinery have been very generous with their time, providing speakers free of charge and professional advice about computers and their use for educators. Seek out professional advice whenever it is offered.

9) Summer camps have been an enormous boon to computing. I recently received a request for information from an equestrian camp. They plan to teach horseback riding in the mornings and computing in the afternoons. Club-Med, for example, teaches seminars on computing once or twice a day. You can learn during your vacation, or you can organize camps and help others learn.

10) The NSF has been supporting a number of computer literacy development projects. We have supported the development of materials for K-8 with a grant to the Human Resources Research Organization of Alexandria, Virginia. The interesting thing about these materials is that they teach kids procedures. Once they know how to follow procedures they are taught algorithms, and algorithms lead to programming and problem solving. These are skills that can be introduced very early. The Minnesota Educational Computing Consortium with NSF support is developing modules at the junior high and high school levels courses in computer literacy. These materials are now available.

11) The media is another area that we should not overlook. In England, the BBC has a computer literacy course that is taught by television. The Sinclair computer which costs under $100 is sold along with the course. It is, in fact, one of the biggest-selling computers in the world. A number of computer literacy programs taught through television are now available in the United States. It can also be used by teachers.

12) You should make an effort tho follow the many journals that emphasize computing that are now available. Some trade journals like Datamation, Computer Decisions, and Technological Horizons in Education are free to educators. Others like Byte Magazine, Creative Computing, Electronic Learning closely follow the trends as they develop. Infoworld and Computer World also do an excellent job of monitoring current developments that should be reflected in computer education.

13) I recently participated in a satellite television conference which broadcast nationally a program on computer literacy. Many people who came had access to TV studios and prerecorded their presentations; all were willing to share their tapes with anyone who wanted them. I am going to be on another panel in the midwest. They want me to talk to their computer meeting by telephone, a very cheap way to obtain speakers. Many people, the very highest ranking people in business, industry, and government are anxious and willing to participate in these educational activities. Telecommunications, video taping, telephone conferencing are all relatively inexpensive ways to obtain intellectual contributions from educational and community leaders.

14) Chautauqua is a series that the NSF has supported which recruits people who are at the cutting edges of science and technology to make a speaking circuit going from university to university. Speakers tell about what they are doing in their fields and about the new discoveries. Chautauqua is also very inexpensive and a very easy way to disseminate information on the cutting edges of science technology. In a field where technology becomes obsolete overnight and where anything that is in print is outdated, it is important to anticipate trends by talking to experts. Educators need a computer literacy chautauqua since so much of what is important in this field is seldom committed to writing.

15) Centralized computer purchases are important; vendors are anxious to give discounts. Group purchases are favored by business and have economic benefits for education.

16) Statewide planning for implementing computer literacy programs is going on in California, Florida, Pennsylvania, and New York. You can benefit from the experience of others who have already initiated planning and pilot activities.

17) Congressional hearings have been held on information technologies and education. Video tape recordings were made during the Congressional hearings and these tapes are available through the U.S. House of Representatives. The videotapes include expert testimony and recommendations for the use of computers in schools, universities, and for vocational education.

18) Clearinghouses for information are very important. CONDUIT is a clearinghouse for computers in undergraduate education at the University of Iowa, and MicroSift for computers at the precollege level is supported by the Northwest Regional Educational Laboratory in Portland, Oregon. These clearinghouses help standardize the documentation procedures and set up select groups who will continuously search for interesting computer-related items

in their disciplines. They offer state-of-the-art reports on computers in various disciplines. They also try out the materials and certify that, in fact, they do work.

19) When it comes to software and courseware, you are not going to be able to purchase the things you want. You are going to have to develop your own materials. Teachers will require places where they can have access to large computers and computing expertise to assist them in developing courseware. The NSF supported a project called COMPUTE at Dartmouth University which could serve as a model for computer courseware development.

20) It must be decided on whose back the computer revolution will ride. Whose responsibility is it to pay for the retooling of teachers? Is it the responsibility of the teacher? the schools? the State? the Federal Government? This is a question that requires much discussion and ultimately community consensus. The fundamental structure of the financing of education must be reevaluated. We cannot have a revolution in our classrooms without first having a revolution within our institutions.

Conclusion

In conclusion, Alaska, which has some very unique geographic disadvantages, may by necessity turn out to be a leader in the adoption of technology. Because of your large geographic expanse and the inadequacy of terrestrial communications, you have already moved into a leadership role in the use of satellite communications and computing and have established the groundwork for computers in education. Technology, however, is not just machines, it involves people and ways of thinking, attitudes, and values. If education is to reap the benefits of computing, it requires strong administrative support, a critical mass of computer literate faculties and students.

John Dewey once wrote: "The educational task cannot be accomplished by merely working on men's minds, without that which affects their institutions." Education will achieve its goal of computer literacy only when computers and information technologies are no longer viewed as educational luxuries for a small elite, but as an educational necessity and tools for all.

APPENDIX B

Keynote Address

COMPUTER CULTURES AND PUBLIC EDUCATION

Dr. Joseph Deken
University of Texas - Austin

COMPUTER CULTURES AND PUBLIC EDUCATION

Joseph Deken
University of Texas - Austin

Computers Will Change the Way We Think

Although people are talking about the ways in which computers will change the way we live, the more fundamental thing in the long run is the way computers will change the way we think. The question that may be most relevant to this conference is how this change in our way of thinking and our new skills in thinking will be communicated effectively through public education. How are we to maintain an educational system that will keep pace with the pace of change?

My contention is that we know very little right now about computers, simply because we are not familiar with the kinds of computers that will be common in the next ten years, or perhaps in the next five years. It is premature to speculate about what computers will do to our ways of thinking. Certainly, if we began to develop a concept of computer literacy based on the IBM card sorter, we would have a somewhat limited view of computer literacy. In the same vein, if we base a view of computer literacy on the BASIC programming language or the Apple computer, however well-intentioned, still we have a somewhat limited notion of what we are going for in terms of computer literacy. Therefore, what I will discuss today is just guessing, but I hope it is informed guessing.

The first way in which computers are changing the way we think is a kind of primacy of experience; that is, we are entering a more experiential world because of the capabilities of computers. In the educational system, there will be a much bigger demand, driven primarily by computer technology, for people to experience what it is that is being taught. People will be less interested in thinking about such things as solid geometry or differential equations, or theories of music if they do not experience them.

I believe that computers will tremendously enlarge the range of things which are adaptable or appreciable by human senses and by human experience; there is a chapter in my book, called "Computing as a Seventh Sense" which discusses the computer as a marvelous instrument for bringing things within human senses that were not perceptible before. Schools may not be able to compete for people's attention if they do not offer an immediacy of experience to the subject matter that they are teaching, and the medium for that immediacy of experience will be primarily the computer.

In the right educational environment, we might hope that this bias towards experience leans towards a predilection for experiment. Rather than merely giving lip service to the scientific process, the notion of experiments and an enlightened, guided empiricism can become part and parcel of the educational process. With the computer as support, students can do experiments, students can find things out experimentally.

The bias toward experience is the first way that computers will change our ways of thinking, and it is something that is already very much in view. What will be the effect of things like video games? What is the effect of computers in the long run? I think all in all that it can be a very good

effect. It can produce our third and fourth grade scientists and 5-year-old epistomologists, as Seymour Papert calls them. And I think the trend in itself can be very productive. At the non-productive end, what we could have is a cult of experience that says "I don't care what it is just so long as the colors are pretty." And this is the dead end of computer games: when all that people will be interested in doing is playing video games, and if it's not a video game, they will not be interested in doing it.

The second way our thinking will change, and this is a little more abstract, is the notion of "actoracy." My contention here is that perhaps the notion of computer "literacy" is off in the wrong direction right from the start. We are using a word, "literacy," because we know what ordinary literacy means. There is a strong prospect, though, that what we are talking about in thinking skills and mental attitudes with computers will be very different from old fashioned "literacy." Perhaps we need a new word.

I propose the term "actoracy" with the following idea in mind. Literacy is based on the word "litera" which means "a letter." To be literate is to be lettered, to be skilled in dealing with letters. Of course, computers have moved us beyond the stage of the dead letter. With computers, the fundamental unit is no longer a simple dead letter. In the world of computers, the unit has become an actor. In fact, there are many computer languages being developed around the concept of an actor--these are the object-oriented languages. The person who has the new skill of thinking does not possess a "literacy" based on letters, but an "actoracy" based on being good with actors. You can think of the mental skills involved, not like those of writing prose or poetry, but more like being able to be a good stage director, or a good choreographer, or a good personnel manager.

The human skills of communication and managerial skills will be applied to making computers do the job you want them to do. But we will not be dealing with employees in a personnel pool or dancers on a stage, but the general things we will deal with are computer procedures and computer actors. What they have is well-defined functions, they have methods for performing those functions and rules and standards of communication which enable us to communicate with them. Just as we cannot go out and organize a Bulgarian dance troupe if all we speak is English, we cannot go out and organize a computer dance troupe or computer actors if all we speak is 20th century prose.

In thinking about actoracy, it is not necessary to assume that people will have to bridge the gap and become more like algebra machines. It may be safer to assume that computers will more and more bridge the gap, and computer procedures and processes will be better packaged in a humanly comprehensible form. Dealing with them from the human side will not be like being an algebraist, but more like being an effective personnel manager.

Skeletal thinking is another way computers may change our ways of thought. A computer is able to fill in the details of a process for which we need only to set up the general design. In many applications, what computers do for us is to bridge the gap between something which we have the idea of how to do, but do not know specifically, or often do not care to know in step-by-step detail. A skeletal thinking approach requires skills in finding patterns, making analogies, setting goals, and evaluating solutions. Brute force calculation, vast knowlege of specifics, and tedious detail are left to the machine.

The School

Given the rapidity with which technology can change and the rapidity with which the assumptions underlying the technology can change, the goal of planning might best be to determine not "what should we do?" but "how will we make the system itself more adaptable?" In this vein, an important thing to do in schools is to put an end to a parasitic view of the educational process where the student, the learner, is not expected to contribute anything substantial to the educational process, much less to something like curriculum. I believe computers will make an end to this view both necessary and even desirable. The only way we will keep up with demands for educational products and tools, and be able to produce and adapt them to the situations we have, is to draw on the resources of every person in the system.

Where does the public school philosophy fit into this? The notion behind public schools is that democracy cannot prosper unless its citizens are well educated, unless its citizens are empowered with the tools to make the democracy function. Obviously, the political process, the whole communications process will rely more and more upon skill with computers. Unless we want to see a schism between an underclass and an upperclass of citizens, the public school system is under a great challenge to provide the kind of education that is relevant today. Schools are now selling public education in competition with, among other things, television and private schools. When we talk about what schools should do to serve the public in guaranteeing universal computer literacy, the question is not whether the public schools do it sooner or later. It may be the case that the public educational system either does it now or loses the opportunity to do it because much of the constituency has gone elsewhere. If that misfortune does occur, public schools will be only the last resort of the underprivileged.

The Home

In addressing the subject of the computer in the home environment, one must mention the use of the computer for entertainment purposes simply because that is where the money is right now. We may be concerned about the products that are being offered for entertainment because a lot of them are dead ends. But there are a lot of good ideas in video games. In fact, Ted Nelson, one the most influential watchers and shapers of computer trends, thinks that the arcade game, Atari Tempest, is the best example of a computer-user interface that he has seen to date. So we might as well face the video game business for what it is. The challenge is to make the material, the media, and the presentation of more productive subjects as attractive and interesting as they currently are in video games.

Another use of computers in the home is the personal development use, that is, the use of computers for education. In general, the missing link in a lot of computer applications is a communications network that is suitable for people to be communicating with each other for computer activity. Alaska presents some very exciting possibilities in this area. With expanding amounts of information, services, products and people available within computer networks, we will see ever increasing uses of the computer for educational personal development activities. Computer networks may fill the role that continuing education programs now serve. People who want to become lawyers or get real estate licenses, or do any number of things may turn to the computer for ease of interaction and the flexibility of scheduling. I think you are going to soon

see educational products such as high school diplomas and college degrees being exported over computer networks. This again could be viewed as a challenge to the traditional structures of other educational systems. It also furnishes a wealth of ideas and a baseline against which a traditional educational system can evaluate itself.

Under the notion of educational and personal development is the idea of the computer as a seventh sense, a new microscope, a new telescope, a new analytical device. As time goes on the use of computers will be an integral part of people's own personal management of information. Whether it's using the computer to sort through news stories, or to find out what skills are involved that relate to your work and your job, the fact is that the computer in the home will be used as an analytical tool to provide a filter on this enormous information explosion that we are immersed in. A person that can use a computer effectively for that end will have timely and relevant information about what is going on.

More and more people will be doing their work and business at home, and this can have good and bad effects. One unsettling effect may be that people's life styles may become much more integrated. Because they happen to be around their children more, we may find parents meddling with things like the school system, and this is a destabilizing type of situation. Whether this new-found interest leads to constructive change or conflict depends largely on the quality of professional leadership.

Finally, a home use which right now is not too common, but which is coming into its own, is the use of computers for effective and manageable communication. People will look to computer networks as sources of communication with people whose judgment they respect and, by combining the judgments of several people, they can get an effective handle on the information explosion. We ought to be trying to get computer technology to enhance person-to-person communication. A faulty view of computing that has emerged is the notion of an isolated person sitting at an isolated piece of equipment doing an isolated task until they are finished with it, and not viewing the computer as both a tool for doing the task and also a porthole into a system of communication with other people. The computer network can do a lot toward changing that image.

In all of these home uses, what we are seeing is people in their own homes gaining experience with, familiarity with, and expectations about what computer technology can do and bringing this experience into their expectations about what a school system should do.

The Computer of the Future

Let me address computer literacy in a newer environment which is just now emerging. There is a single theme behind it all: computers as we know them have been "floating-brain" computers. There is not much interaction and linkage with the real world. But the computer will evolve into something which can sense and react to the real world directly. This is what I call the Sensation/Action Paradigm. If you imagine how limited a person would be without sensory or muscular capabilities, I think you can see in some sense how limited current computers are and what we might be talking about when computers break through this "floating-brain" barrier. Examples that you may know about already are computing devices like Papert's Turtle that walks around in the classroom. The child does not have to sit in front of a TV screen, but can walk around the room and follow the Turtle if the child feels like walking

walking around the room. I think it would be a very bad thing if computer literacy actually meant more and more people would be spending more and more time with their fingers glued to keyboards sitting in front of TV screens, and this apprehension is especially relevant in areas such as early childhood learning. Sitting and staring is not an appropriate activity, developmentally and physically, for a young child. I believe that computers have a tremendous educational potential for children of very young ages, but only if the computers they use differ from the video display/keyboard type that we are accustomed to. The computer of the future really is three things: sensation, processing, and action. We have had experience with only one aspect, the processing part. We have not had much experience with computer sensation devices, and we have not had much experience with computer action devices. But in a large part these devices will shape the whole nature of what computers are and what they will mean. I think we might see some substantial effects of computer sensation and action within five years.

The sensation/action paradigm is relevant to what I would call the anthropological shortcomings of computers as they now exist. Computers and interfaces that we have today really do not take into account that the human system has evolved over a long period of time and has evolved to do many tasks very well, and it is not likely to evolve more because a keyboard exists, at least over the time that it will take to implement computers on a large scale. Our goal ought to be to understand more about what the human requires out of an intellectual environment, a computing environment, that will make it productive and humanly enhancing in the long run. I think it is an assault on the human physical makeup to require spending long hours sitting in one place or even staring at one location. We ought to design computers to fit humans, not vice versa, since now we can envision a world in which computer devices will be part and parcel of a human's life from the day they are born to the day they die. The fact is that we are in a computer milieu now, and it is even more important to design computers in such a way that the human style that emerges from interacting with these devices does not put a strain on humans or change human characteristics in ways that we would not be too happy about.

The Computer as a Communications Device

The personal computer that does not include a communications interface has a social drawback and ought really to go the way of the Model T Ford. Rather than viewing the computer as an island, we ought to think of it as our personal porthole or viewport onto the world. And a large portion of that world consists of other people. The computer should give us a view not only into some particular content area, but also into the community that we are part of. In multi-window computer systems, several jobs can be going on and sharing "windows" of the computer screen at one time, and the operator can concentrate on any one of them in turn. What I am saying is that a little window with a telephone or some other device should always be one of the activities running on a person's computer. Then if he or she feels like talking to someone else, or needs some help, or wants to know what other people have done in similar situations, the computer can facilitate that kind of communication. Interpersonal contact is something so fundamental to making a good society that we should try to mobilize and maximize it in computer technology rather than hoping it will take care of itself, because I don't think it will. I think there is a great potential here, and I think it should be implemented with computers.

Community Cooperation

A final important thing to talk about with regard to computer resources is the need for, and in Alaska I think the great potential for, cooperation between the home, the school, and the community at large. The key here is the notion of what I call transportable and negotiable data. In some ways this is the hallmark of the computer era. If you develop an idea for doing something with the computer and you have a computer network, then you can send it from Anchorage to New York City in a matter or minutes. It is transportable. But it is also negotiable: a computer program can immediately begin to go to work in New York City, although you have just sent it from Anchorage. This notion of transportable and negotiable data means there is no longer a reason to isolate or encapsulate all of the education resources that exist within a community. We ought to be talking about economies of scale, we ought to be talking about mobilizing all of the resources of a community to support the entire educational effort of that community. There are many information managing, information manipulating kinds of resources from fancy printers and movie-making devices to large storage devices to network subscriptions that probably are beyond the economic means of individuals in the community, but are worthwhile to be coordinated and managed by community information resources. I think certainly that given the sort of information infrastructure which exists in Alaska, it makes it possibly the most interesting place to say, "Can't we use now what is apparently a statewide resource in terms of communication to make sure the communities and the State as a whole are sharing resources in a productive and economically worthwhile fashion?"

Conclusion

In conclusion, the question is where do the schools stand. Let me say that I think the school and particularly the public school, regardless of whatever else happens, should remain as a resource in terms of socialization. I think that what the school should provide is a good model of social behavior. In addition to the question of socialization, there is the question of equity. That is, we cannot allow segments of society to be excluded economically or otherwise from the mainstream of intellectual activity. More and more, this activity is going to revolve around the use of the computer. For socialization, for equity, the computer and the school using the computer is really best seen as a catalyst. It does not really insert anything into the system or provide the power for the system, but rather mobilizes energy that is already there. It mobilizes the energy of the students, it mobilizes the energy of the teachers, and the community at large so that they can be as productive as possible and that they can all contribute to one another.

APPENDIX C

SELECTED BIBLIOGRAPHY OF RECENT PUBLICATIONS
ON COMPUTER LITERACY AND EDUCATION

Overview of the computer literacy area and issues

Computer literacy definitions

Examples of computer literacy curricula for students

Teacher literacy development

Use of computers in education

Computer education for vocational purposes

Overview of the Computer Literacy Area and Issues

Braun, Ludwig. Computer-aided learning and the microcomputer revolution. Programmed Learning and Educational Technology 18(4): 223-229, 1981.

Clouse, R. Wilburn; Savage, Edward M. Educational policy issues related to computer literacy in rural school systems. Journal of Educational Technology Systems 10(4): 343-156, 1981.

Dekin Joseph. The Electronic Cottage. New York: Wm. Morrow & Co., 1982, 341 pp.

Grady, David. A hard look at the world of educational computing. Personal Computing 6(8): 40-44, 1982.

Holzman, T.G.; Glaser, R. Developing computer literacy in children--Some observations and suggestions. Educational Technology 17(8): 5-11, 1977.

Magarrell, Jack. Computer literacy gaining place in undergraduate curriculum. The Chronicle of Higher Education XXIV(8): 1, 1982.

Masat, Francis E. Computer Literacy In Higher Education. AAHE-ERIC/Higher Education Research Report No. 6, 1981, 63 pp., ED 214446.

Molnar, Andrew R. The next great crisis in American education: Computer literacy. Journal of Educational Technology Systems 7(3): 275-285, 1978.

Molnar, Andrew R. The next great crisis in American education: Computer literacy. AEDS Journal 12(1): 11-20, 1978.

Neufeld, Helen H. Reading, writing and algorithms: Computer literacy in the schools. Claremont Reading Conference, Claremont, CA, January 1982, 10 pp., ED 211959.

Seelig, Anita. Home, hearth and computing. Personal Computing 6(9): 140-144, 1982.

Stewart, George. How should schools use computers? Popular Computing 1(2): 104, 106 & 108, 1981.

Varven, Jean. The schoolhouse Apple. Softalk 2(10): 207-210, 1982.

Wilson, Kara Gae. English teachers: Keys to computer literacy. English Journal 70(5): 50-53, 1981.

Molnar, Andrew R. Understanding how to use machines to work smarter in an information society. The Computing Teacher 7(5): 68-73, 1980.

Molnar, Andrew R. The coming of computer literacy: Are we prepared for it? Presented at the Fourth International Congress on Mathematical Education, Berkeley, California, August 12, 1980.

Molnar, Andrew R. The search for new intellectual technologies. T.H.E. Journal September 1982, pp. 104-112.

Rawitsch, Don G. Minnesota's statewide push for computer literacy. Instructional Innovator 27(2): 34-35, 1982.

Computer Literacy Definitions

Anderson, Ronald E. et al. In defense of a comprehensive view of computer literacy--A reply to Luehrmann. Mathematics Teacher 74(9): 687-690, 1981.

Hansen, Thomas P. et al. What teachers think every high school graduate should know about computers. School Science and Mathematics 81(6): 467-472, 1982.

Hunter, Beverly. Computer literacy. Patterns Conference on Computer Literacy, Rochester, NY, April 27, 1981, 13 pp., ED 207617.

Inskeep, James E., Jr. Computer literacy: What it is and why we need it. Curriculum Review 21(2): 138-141, 1982

Johnson, David C. et al. Computer literacy: What is it? Mathematics Teacher 73(2): 91-96, 1980.

Johnson, Mildred Fitzgerald. Computer literacy: What is it? Business Education Forum 35(3): 18-22, 1980.

Luehrmann, Arthur. Computer literacy--What should it be? Mathematics Teacher 74(9): 682-686, 1981.

Luehrmann, Arthur. .Computer literacy: What it is; why it's important. Electronic Learning 1(5): 20-23, 1982.

Moursund, David. Precollege Computer Literacy: A Personal Computing Approach. International Council for Computers in Education, Department of Computer and Information Science, University of Oregon, Eugene, Oregon 97403, 1981, 25 pp.

Obie, Ed. Computer literacy: What does it mean for educators. Paper delivered at AACE Conference, Anchorage, April 1982, 8 pp.

Papert, Seymour. Mindstorms; Children, Computers and Powerful Ideas. New York: Basic Books, 1980, 230 pp.

The, Lee. Squaring off over computer literacy. Personal Computing 6(9): 58-64, 69-72, 1982.

Van Loan, Charles F. Computer science and the liberal arts student. Educational Forum 45(1): 29-42, 1980.

Wakin, B. Bertha. Business dynamics: A new direction for a new decade. Business Education Forum 35(5): 11-12, 1981.

Watt, Daniel. Should children be computer programmers? Popular Computing 1(11): 130-133, 1982

Examples of Computer Literacy Curricula for Students

Aiken, R.M.; Moshell, M. Computer power. The Computing Teacher 9(8): 12-14, 1982.

Beyer, Kathleen; Moursund, David. Computer Education for Elementary and Secondary Schools, ACM order No. 812810.

Denenberg, Stewart A. An alternative curriculm for computer literacy development. AEDS Journal 13(2): 156-173, 1980.

Denenberg, Stewart A. Using a semantic information network to develop computer literacy. Journal of Computer-Based Instruction 7(2): 33-40, 1980.

Gress, Eileen K. A Computer-literacy model for the junior high school. Arithmetic Teacher 29(7): 46-49, 1982.

Hunter, Beverly. An Approach to Integrating Computer Literacy Into the K-8 Curriculum. Human Resources Research Organization, Alexandria, VA, October 1980, 12 pp., ED 195247.

Hunter, Beverly, My Students Use Computers: Curriculum Plans for Grades K-8. Human Resources Research Organization, Alexandria, VA & Montgomery County Public Schools, Maryland, August 1981.

Hunter, Beverly. Computer literacy in grades K-8. Journal of Educational Technology Systems 10(1): 59-66, 1981.

Joseph, Helen. Lesson Plan for Computer Literacy Unit (3 Weeks). Grades 7-9. (Revised Teaching Guide), March 3, 1982, 50 pp., ED 216898.

Kirchner, Alice M. One state's approach to computer literacy. Technological Horizons in Education 8(4): 43-44, 1981.

Lambrecht, Judith C. New microcomputer teaching competencies. Balance Sheet 63(5): 233-236, 1982.

Murphy, Edward J. Developing computer literacy in K-12 education. The Computing Teacher, November 1981, pp. 43-48.

Neill, Michael J. Recommendations for Implementing Computer Literacy in Oregon Secondary Schools. Oregon State Department of Education, Salem, September 1976, 13 pp., ED 217866.

Patton, Robert et al. Computer Literacy for All High School Students. Teaching Guide, May 2, 1981, 26 pp., ED 216679

Science Research Associates, Computer Discovery; Chicago, 1981, 127 pp.

Targ, Joan. Computer teachers: An innovative approach to computer literacy. Part I: The early stages. Educational Computer Magazine 1(1): 8-10, 1981

National Science Foundation. Pre-college Mathematics Education Using Computers. 1980-81, pp. 22.

Teacher Literacy Development

Braun, Ludwig. A national tragedy is taking shape. Classroom Computer News 2(2): 3, 1981.

Diem, Richard A. The role of technology in teacher education: Preparation for the twenty-first century classroom. American Association of Colleges for Teacher Education, Houston, February 1982, 13 pp., ED 212596.

ETA Staff. Educational Technology for Alaska - Training Manual. Office of Educational Technology and Telecommunications, Alaska State Department of Education, August 1981, 94 pp.

Gagne, Robert M. et al. Planning and authoring computer-assisted instruction lessons. Educational Technology, September 1981, pp. 17-26.

Giffel, Terry C. A software writer's checklist: 10 steps to better teacher-made software. Classroom Computer News 1(6): 35, 1981.

Hedges, William D. Parlez-vous PILOT? Sprechen sie BASIC? Deciding which language is best for you. Classroom Computer News 1(6): 44-45, 1981.

Heise, David. Educators and the knowledge revolution. Educational Computer Magazine 1(3): 30-31, 1981.

Hirschbuhl, John J. The design of computer programs for use in elementary and secondary schools. Journal of Educational Technology Systems 9(3): 193-206, 1980.

Johnson, Jo Rykken. Making the transition to computers easy. Educational Computer Magazine 1(2): 16-19, 1981.

Kleiman, G.; Humphrey, M. Writing your own software. Authoring tools make it easy. Electronic Learning 1(5): 36-41, 1982.

Kurshan, Barbara. Computer technology and instruction: Implications for instructional designers. Educational Technology, August 1981, pp. 28-30.

Lopez, Antonio M., Jr. Computer literacy for teachers. High school and university cooperation. Educational Technology 21(6): 40-41, 1981.

The lowdown on languages. Classroom Computer News 1(6): 40-41, 1981.

Moursund, David. Introduction to computers in education for elementary and middle school teachers. The Computing Teacher 8(3): 26-34, 1980.

Myers, Darlene. How can educators become computer literates? The Computing Teacher 8(3): 34-42, 1980.

Olds, Henry F., Jr. The making of software. Classroom Computer News 1(6): 20-21, 1981.

Rawitsch, Don G. Teaching educators about computing: A different ballgame. The Computing Teacher 9(4): 27-31, 1981.

Roberts, Harold Pepper. Linking computer to curriculum starts with the teacher. Educational Computer Magazine 1(1): 27-28, 1981.

Roblyer, M.D. Courseware: Developing computer courseware must be easier than some things. Educational Technology, January 1982, pp. 33-35.

Rushinek, Sara F.; Rushinek, Avi. User participation in an interactive software design. Journal of Educational Technology Systems 10(2): 165-173, 1981.

Sherwood, Robert D. et al. Developing computer literacy and competency for preservice and inservice teachers. Journal of Computers in Mathematics and Science Teaching 1(2): 23-24, 1981.

Underwood, John. Using PILOT for "conversational" foreign language programs. Educational Computer Magazine 1(4): 33 & 50, 1981.

Wagner, William J. Author languages: Instruction without programming. Classroom Computer News 1(6): 42-43, 1981.

Use of Computers in Education

Auten, Anne. ERIC/RCS: Computer literacy, Part III: CRT graphics. Reading Teacher 35(8): 966-969, 1982.

Beauchamp, K.G. Schools computer education in Australia. British Journal of Educational Technology 13(1): 56-64, 1982.

Bingham, Margaret; Manock, John J. Providing assistance for the implementation of educational microcomputers--a statewide approach. Technological Horizons in Education 9(4): 101-105, 1982.

Braby, Richard; Kincaid, J. Peter. Computer aided authoring and editing. Journal of Educational Technology Systems 10(2): 109-123, 1981.

Bristol, John L. et al. State of the art. Voc Ed 57(3): 40-45, 1982.

Chambers, J.; Bork, A. Computer assisted learning in U.S. secondary and elementary schools. The Computing Teacher 8(1): 50-51, 1981.

Damarin, Suzanne K. Technology in the classroom. Iniative or response? New directions in curriculum development. American Association of Colleges for Teacher Education, Houston, February 1982, 6 pp.

Ebersole, Gerri Noonan. Microcomputers in the classroom: Electronic carrots. Today's Education: Social Studies Edition 71(2): 26-78, 1982.

Fuerzig, W. et al. Microcomputers in Education. Bolt, Beranik & Neuman, Inc. Prepared for the National Institute of Education, 1981, 113 pp.

Gleason, Gerald T. Microcomputers in education: The state of the art. Educational Technology 21(3): 7-18, 1981.

Grossnickle, Donald R.; Laird, Bruce A. Profile of change in education: A high school uses microcomputers. Educational Technology, December 1981, pp. 7-11.

Helper, Molly L. Conduit: A pipeline to better educational software. Classroom Computer News 2(1): 24-25, 1981.

Hirschbuhl, Katherine. The need for computer literacy and computer applications in the nation's classrooms. Journal of Educational Technology Systems 9(3): 183-191, 1980.

Hunka, Steve. CAI developments in Canada. Technological Horizons in Education 8(1): 57-59, 1981.

Individualized Study By Technology: Integrating CAI Into Core Curriculum. Office of Educational Technology and Telecommunications. Alaska State Department of Education, 7 pp.

Jenkins, Tracie M.; Dankert, Elizabeth J. Results of a three-month PLATO trial in terms of utilization and student attitudes. Educational Technology, March 1981, pp. 44-47.

Jones, Aubrey B., Jr. Computers are their thing. Technological Horizons in Education 8(1): 54-56, 1981.

Landry, Michael. Algebra and the computer. Mathematics Teacher 73(9): 663-667, 1980.

O'Connor, Vincent F. When computer meets kid in middle school math. Classroom Computer News 2(4): 60-61, 1982.

O'Donnell, Holly. ERIC/RCS: Computer literacy, Part I: An overview. Reading Teacher 35(4): 490-494, 1982.

O'Donnell, Holly. Computer literacy, Part II: Classroom applications. Reading Teacher 35(5): 614-617, 1982.

Prentice, Lloyd; Beckelman, Laurie. Classroom computer news. Instructor 91(3): 85-90, 1981.

Use of Computers in Education

Rawitsch, Don G. Minnesota's statewide push for computer literacy. Instructional Innovator 27(2): 34-35, 1982.

Scanlon, Robert G. Computer revolution and resource sharing: Bridge to better schools. Technological Horizons in Education 9(4): 77-78 & 82, 1982.

Wrege, Rachael. Hands on?? Popular Computing 1(8): 110-123, 1982

Zakariya, Sally Banks. The computer goes to school. Principal 61(5): 16-20 & 52-54, 1982.

National Science Foundation. Technology in Science Education: The Next Ten Years. July 1979, pp. 37.

National Science Foundation. Science & Engineering Education for the 1980's & Beyond. October 1980, pp. 82.

ETA Newsletter, Volumes 1-3 (1980-1982); A publication of the Office of Educational Technology and Telecommunications, Alaska Department of Education.

Computer Education for Vocational Purposes

Alexander, Wilma Jean. Microcomputers: Impact on society and education. Business Education Forum 35(8): 19-21, 1981.

Austing, Richard H. A study of computer impact on society and computer literacy courses and materials. Journal of Educational Technology Systems 7(3): 267-274, 1978

Carroll, Jane. Computing literacy: Springboard to success. Personal Computing 6(9): 45-48, 1982.

Dowlin, C. Edwin. Education for the electronic library. Drexel Library Quarterly 17(4): 77-90, 1981.

Edwards, Judith B. et al. Elements of Computer Careers. Northwest Regional Educational Lab., Portland, Oregon, 1977, 351 pp., ED 216683.

Guthrie, John T. Research: One computer literacy skill. Journal of Reading 24(5): 458-460, 1981.

Kearsley, G. et al. The Use of Microcomputers for Training: Business and Industry. Human Resources Research Organization, Alexandria, Virginia, 1981, ED 207598.

Kitch, Dale. Computer literacy: The fourth basic skill? Business Education Forum 35(2): 22-23, 1980.

Mason, E. Microcomputers in training programs. Viewpoints in Teaching and Learning. In press.

McClurg, Ronald. Computer Equipment and Curriculum Requirements for Quality Data Processing Instruction. Research & Development. Final Report. Iowa State Department of Public Instruction, Des Moines, December 1981, 37 pp., ED 215093.

Mitchell, Robert E. Tomorrow's school office today. American School and University 54(8): 30 & 35, 1982.

Orr, William T., Jr. et al. Committed to computers. Florida Vocational Journal 7(4): 8-16, 1982.

Romans, Anne F.; Ransom, Stanley A. An Apple a day: Microcomputers in the public library. American Libraries 11(11): 691-693, 1980.

Staman, E. Michael. Computing and office automation. Changing variables. Association for Institutional Research, Florida State University, Tallahassee, Summer-Fall 1981, 9 pp., ED 213377.

Uthe, Elaine F. New communication skills in the age of "Interfacing." Business Education Forum 35(6): 11-13, 1981.

Wallace, I. Computers in typing class. Business Education Forum 36(2): 27-28, 1981.

Zahn, Donald K. The impact of the computer in the business classroom. Business Education Forum 35(6): 25-26, 1981

APPENDIX D

THE STATUS OF COMPUTER LITERACY TRAINING IN ALASKA:
A SURVEY OF THE SCHOOLS IN DECEMBER 1982

Comments of respondents in the computer literacy surveys

THE STATUS OF COMPUTER LITERACY TRAINING IN ALASKA

A SURVEY OF THE SCHOOLS IN DECEMBER 1982

A telephone survey was conducted as part of a larger study of computer literacy in the public schools of Alaska. The survey, which focused on the status of computer literacy programs for students and adults, and priorities for future planning, was conducted by Systems for Training and Applied Research, Inc., Lexington, Kentucky under contract to the Department of Education. The objective of the survey was twofold. First, information about the current status and availability of training in the areas of computer literacy were explored. Second, respondents were requested to indicate the priority they would attach to various aspects of computer literacy. The availability of programs for students and adults was also investigated.

SAMPLING PLAN

The sampling plan was designed so that input would be obtained from all the school districts in Alaska. The districts were classified into the following three groups (See Table 3 for the assignment of districts to groups):

1) Rural City
2) Urban City
3) REAA

The total sample size of 140 was chosen so that no type of district would have less than 35 representatives for the purposes of making reasonably accurate estimates of the views represented within the group. In addition, the contact persons for the Educational Technology for Alaska (ETA) Project who were assumed to be relatively knowledgable about computer literacy were also included in the survey.

Since the data would contribute to an overall state plan for computer literacy education, the sample was further designed to give proportional representation to each district. That is, each district was sampled approximately according to its proportionate share of the State population. Thus, the key features of the sample were:

1) All districts in the State of Alaska were sampled.
2) The respondents were chosen randomly from the population of educators in the state.
3) The design enabled separate study of the three kinds of school districts listed above.
4) The design enabled comparison of the randomly chosen district personnel with the ETA contact persons.

PROCEDURES

The survey was conducted during the first two weeks in December 1982. All respondents were contacted by telephone, explained the purpose of the study, and asked the questions. They were given opportunity to express their views as the survey questions were being administered, and a the end of the survey. When the interviewers called a district or school, they asked to speak to the admininistrator in charge at that location. Often this was not possible, and the interview was conducted with

another professional person at the site such as a teacher, counselor, psychologist, or librarian. A list of the job titles of those responding is shown in Table 1.

Table 1

Job Titles of the Survey Sample

JOB TITLE	NUMBER
Superintendent	28
Principal	55
Vice Principal, Assistant Principal, or Head Teacher	7
Librarian	7
Counselor	5
Teacher	31
Psychologist	2
Other (IMC Director, Data Proc. Director, etc.)	5

After the data were collected, they were tabulated and interpreted. The results of the tabulation are discussed in the following sections.

RESULTS

Table 2 summarizes the results of the survey. It shows a breakdown by type of district, ETA contact persons, and total sample. In the table, the percent of respondents who answered YES is indicated next to each item. This percentage may be interpreted as indicating the relative frequency that training is offered in Alaskan schools in each topic. The table also displays the mean and standard deviations of the priority ratings given to each item by the respondents. Priority was rated on a three point scale. A high priority rating (3) meant that the respondent considered this topic as important as English, mathematics, science, and other regular school subjects. A medium (2) priority would place it with such subjects as home economics, art, and music. A low priority rating (1) indicated that the respondent did not think the schools should provide such training.

Table 2
Results of the Survey of Current Status of Computer Literacy Training in Urban, Rural City, and REAA Schools, and ETA Contact Persons in Dec. 1982

TOPIC	AVAILABLE CURRENTLY % of YES	PRIORITY FOR PLANNING Mean	SD
1. GENERAL KNOWLEDGE OF COMPUTERS (such as, the history of computers computer vocabulary, various types of computers, and career opportunities in computers)			
URBAN	66.7	2.64	.54
RURAL CITY	85.7	2.74	.51
REAA	71.7	2.77	.54
Total	73.8	2.70	.53
ETA	36.2	2.81	.52
2. GENERAL APPLICATIONS OF COMPUTERS (such as, word processing, data bases, information access & retrieval, security of computerized information and records, computer networks (i.e. communications, resource, and distributed processing)			
URBAN	56.1	2.55	.64
RURAL CITY	80.0	2.63	.49
REAA	59.0	2.59	.54
Total	62.9	2.70	.53
ETA	58.3	2.69	.58

Table 2 (continued)	% of YES	Mean	Sd
3. INDUSTRIAL and VOCATIONAL USES			
(e.g. Process control, voice recognition, sound synthesis, computerized instruction, robots)			
URBAN	18.2	1.98	.83
RURAL CITY	40.0	2.37	.49
REAA	38.9	2.46	.64
Total	29.3	2.21	.78
ETA	38.9	1.58	.65
4. PROGRAMMING OF COMPUTERS			
(e.g. Types of user languages, concepts and techniques of programming, flowcharting, designing algorithms, designing programs)			
URBAN	53.0	2.14	.74
RURAL CITY	65.7	2.40	.65
REAA	61.5	2.54	.55
Total	58.6	2.31	.69
ETA	55.6	2.39	.64
5. BUSINESS USES OF COMPUTERS			
(e.g., financial records & payroll, management Systems, planning and decision-making, forecasting)			
URBAN	22.7	2.39	.59
RURAL CITY	51.4	2.46	.66
REAA	48.7	2.39	.59
Total	37.1	2.25	.80
ETA	58.3	2.12	.82

Table 2 (continued)	% of YES	Mean	SD
6. USES IN THE HOME			
(e.g., liesure uses and games, living with technology, home record-keeping, home study)			
URBAN	56.1	1.79	.73
RURAL CITY	40.0	1.94	.64
REAA	35.9	1.82	.64
Total	30.7	1.84	.68
ETA	44.4	1.89	.75
7. HARDWARE AND SOFTWARE			
(such as, components, evaluation, graphics, capabilities and compatibility of equipment and programs, and operating them)			
URBAN	56.1	2.44	.70
RURAL CITY	65.7	2.43	.61
REAA	53.8	2.31	.61
Total	57.9	2.40	.65
ETA	58.3	2.33	.59
8. RESEARCH USES OF COMPUTERS			
(such as)roblem solving, simulation, scientific applications (e.g. timing or measurement in experiments), statistics, data gathering)			
URBAN	40.9	2.44	.70
RURAL CITY	40.0	2.44	.61
REAA	30.8	2.31	.61
Total	37.9	2.11	.65
ETA	38.9	2.19	.67

Table 2 (continued)

9. To your knowledge does your school (or district) have a computer literacy program?

	For students % YES	For adults % YES
URBAN	59.1	50.0
RURAL CITY	71.4	62.9
REAA	64.1	43.6
Total	63.6	51.4
ETA	66.7	47.2

10. Do you think computer literacy should be treated as a separate subject or as part of the regular curriculum integrated with math, language arts, reading, science, and so on?

	INTEGRATED	SEPARATE SUBJECT	BOTH
URBAN	56.1	16.7	27.3
RURAL CITY	51.4	14.3	28.6
REAA	53.8	17.9	28.2
Total	51.4	16.4	27.9
ETA	55.6	19.4	25.0

11. Do you use computers:	AT HOME	AT WORK	BOTH
URBAN	9.1	36.4	21.2
RURAL CITY	00.0	40.0	22.9
REAA	00.0	48.7	28.2
Total	4.3	40.7	23.6
ETA	00.0	47.2	30.6

Table 2 (continued)

12. Do you:	WRITE COMPUTER PROGRAMS	USE PACKAGE PROGRAMS	BOTH
URBAN	1.5	48.5	22.7
RURAL City	2.9	40.0	28.6
REAA	2.6	46.2	28.2
Total	2.1	45.7	25.7
ETA	00.0	52.8	33.3

Table 3

Classification of districts for the present survey.

REAA	Rural City	Urban
Adak Region	Bristol Bay Borough	Anchorage
Alaska Gateway	Cordova	Fairbanks
Aleutian Region	Craig	Juneau
Annette Island	Dillingham	Kenai Peninsula
Bering Strait	Galena City	Ketchikan
Chatham	Haines	Kodiak
Chugach	Hoonah	Mat-Su Borough
Copper River	Hydaburg	
Delta/Greely	Kake	Sitka
Iditarod	KingCove	Valdez
Kuspuk	Klawock	
Lake & Peninsula	Nenana	
Lower Kuskokwim	Nome	
Lower Yukon	Pelican	
North Slope	Petersberg	
Northwest Arctic	St. Mary's	
Pribilof	Sand Point	
Railbelt	Skagway	
Southeast Island	Tanana	
Southwest Region	Unalaska	
Yukon Flats	Wrangell	
Yukon Koyuk	Yakutat	

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SUMMARY OF MAJOR FINDINGS

1. Urban schools generally appear to have less developed computer literacy programs than the rural cities and the REAA districts.

2. Urban school personnel tended to attach a lower priority to computer literacy than their colleagues in rural cities and REAAs.

3. Respondents from the rural cities and REAA districts tended to respond more like eachother than like their colleagues from the more urban areas.

4. Industrial and business applications of computers were rated as requiring a higher priority by rural than by urban respondents.

5. Programming, general applications of computers such as word processing and data base uses, and knowledge of hardware and software were given highest priority, while home uses were rated considerably lower in priority as components of computer literacy programs.

6. Greatest priority overall was given to General Knowledge (history, vocabulary, type of computers, career oppportunities).

7. Most computer users in the schools do not write their own software. Further, more than half of the respondents used computers at work.

8. Most respondents tended to favor integrating computers into the regular curriculum rather than treating it as a separate subject.

9. Computer literacy programs are more common in rural city districts than in others.

10. Although computer applications in business and industry were given relatively high priorities, especially by rural city and REAA respondents, they were not currently being taught in many locations.

COMMENTS OF RESPONDENTS IN COMPUTER LITERACY SURVEYS

Telephone Survey:

*We are thrust into the Comptuer Age, and we have been sleeping!

*Our district places high priority on computer literacy for adults and students.

*High schools need support, labs, and all the computers they can get. We also need hook-ups to data banks.

*Our librarian uses a computer and teaches students; teachers check out the computer from the library.

*Great! This is needed in our state more than anywhere else.

*Only the surface is scratched with regard to use of computers in Alaska; but, Alaska should lead the nation!

*Only a limited number of students have an opportunity to take the computer course.

*Computers should be addressed as a foreign language and should be taught throughout the school year. Summer programs with stipends should be provided for teacher training in computers.

*Our greatest need is instruction in programming for teachers.

*Our high school students work with the younger students on computing.

*I am interested in ISC courses being developed in upper level courses such as calculus, trigonometry, physics and chemistry.

*Computer Science teachers should work with teachers to help implement in classrooms.

*This is the coming thing--we need more computers!

*It is good that the State is doing this. Good resource.

*I am glad this survey is being taken so that computer literacy is investigated and supported.

*The State should consider giving funds to further computer literacy.

*We need leadership in this area. Training of teachers is essential.

*A real need for it; future depends on it.

*Our Board of Education has an ongoing committee on computer literacy, and recently the State Department of Education has given a lot of help. The moderate priority answers were given because I think it's necessary for students to be very knowledgeable with the basic curriculum such as math, science, and language arts before they can fully comprehend computers and their concepts and uses.

*Staff training is needed. Training center is going to be operational in the Spring which will establish computer literacy programs for the staff.

*Fundings are needed in this district to purchase hardware.

*We have to get into this in a big way.

*I work with high school seniors who are becoming aware that some colleges are requiring computer literacy for entrance. It is important for them to become computer literate.

*The Department of Education should help buy more computers.

*We should orient parents to home uses of computers. The need to do something is great.

*We need a central library to be set up to copy programs and send them out to the districts.

On-Site Conference Survey:

*This survey does not give enough attention to the use of computers as a communications device. I thimk Joseph Deken's emphasis on communications should be reflected in the plan to the Legislature. I would suggest making easy access to telecommunications facilities in addition to electronic mail, such as computer conferencing (as in the Network Nation by Hiltz and Turoff). There is an attempt at grass roots computer conferencing with the communities that can be freely accessed. However, a more structured and still flexible system could be developed. This type of a network could also be used for learning activities in all disciplines, to facilitate learning at secondary and (especially) post-secondary levels. It is a way of facilitating distance learning at a response speed that will not frustrate students with delays that normally occur with the U.S. Mail delivery to "the bush."

Get the Legislature to require computer conferencing at the University/Community College/Rural ed. level. That is probably the only way it will happen in the near future.

*I am not a member of the educational community, per se; however; in attending this day's session, I feel that the most important aspect that should be emphasized in any message to the Legislature is the point brought out by Deken about the importance of the network of communication as a statewide tool. I think that if I were in a position to do anything I could, I would use the issue of legislative access to the obvious advantage of computer literacy. I would give every household in Alaska a terminal and a network context and then stand back and watch the explosion!

*I feel that the ideal is to have computer literacy addressed as a separate subject AND integrated. We need to teach the use of computers AND integrate its useage.

*Any computer literacy program should not be limited to educational system--make it public for home, business and school.

*There should be more computer literacy courses at the University of Alaska for which teachers can receive graduate credit.

*How is the University system meeting the needs of educators in the State with regard to computer literacy? Poorly.

This was a wonderful session, though I feel more boggled with the realities of a two dimensional "literacy" plan than ever!

*Somehow, I am at once disappointed in and suspicious of being invited to a one day conference only to discover upon my arrival that the remainder of the conference is by invitation only--and that I am not invited. We talk of the "underclass" student. Is there also an underclass citizen. Is there an elite establishment with some power base that will make decisions and suggestions to the Legislature--and we are only here to lend credibility? Why aren't we eligible for the other two days? Or--as a matter of manners, why not inform in the brochure.

*If anything, computers should be de-emphasized. It's expensive. It's a waste--soon all the software that is needed will be available. We don't need more people to make software. It's dangerous--there does not exist a computer system that someone can't break into. I don't like the idea of having millions of people having skills which would enable them to easily steal billions. It's unhealthy--I don't like the idea of having kids in rooms filled with cathode ray tubes. It's not the job prospect of the '80s. Computers are designed to put people out of work and they do it very nicely. "I've seen more brains destroyed by computers."

*The University also have a responsibility to impart "literacy" and a pressing need is to get a "literate" faculty.

*Please don't limit yourselves to the K-12 structure. Think in terms of lifelong learning--educational credits from the permanent fund.

*There is a grass roots movement that is very powerful among teachers. It is important that this be recognized, and work be done with them, as well as top-down work with administrators.

*I believe the community colleges should be represented on any planning teams for computer literacy legislation. It will fall primarily to community colleges to provide computer literacy for the majority of the adult population. Also, we are planning, at least in Anchorage, to integrate use of computers in all subject areas.

APPENDIX E

COMPUTER LITERACY PLANNING CONFERENCE PARTICIPANT LISTS

Workgroup on citizen computer literacy

Workgroup on vocational computer literacy

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APPENDIX F

AGENDA FOR COMPUTER LITERACY PLANNING CONFERENCE

Sample program goals or objectives

Five definitions of computer literacy

AGENDA FOR ALASKA STATEWIDE COMPUTER LITERACY PLANNING CONFERENCE

MONDAY, DECEMBER 13, 1982--General Session:

8:30- 9:00	Coffee
9:00- 9:15	Welcome and Orientation *(DOE Representative & Conference Chairman)*
9:15-10:15	Keynote Address *(Andrew Molnar, National Science Foundation)*
10:15-10:30	Questions and Discussion *(Conference Chairman)*
10:30-10:45	Break - coffee and donuts
10:45-12:00	Videotape: "Uses of Microcomputers in Education"
12:00- 1:15	Lunch
1:15- 2:15	Keynote Address *(Joseph Deken, University of Texas-Austin)*
2:15- 2:30	Questions and Discussion *(Conference Chairman)*
2:30- 2:45	Coffee Break
2:45- 4:00	Panel and Group Discussion: "Approaches to Computer Literacy" *(Molnar, Deken, Smith, Mason)*
4:00- 5:00	Summary and Completion of survey instrument by all conference participants

TUESDAY, DECEMBER 14, 1982--The Two Workgroups Convene Separately:

9:00- 9:30	Survey Results - Phone and Conference Attendees
9:30-10:30	Definition of Computer Literacy
10:30-10:45	Break
10:45-12:00	Review & Reconciliation of Other Workgroup's Definition/Definitions
12:00- 1:15	Lunch
1:15- 2:15	Program Goals
2:15- 3:15	Topics of Instruction or Courses Required to Meet Program Goals
3:15- 3:30	Break
3:30- 4:00	Teacher and Administrator Training
4:00- 4:30	Timetable
4:30- 5:00	Other Issues - Presented for discussion
5:00	Close sessions

WEDNESDAY, DECEMBER 15, 1982--The Two Workgroups Convene Separately:

8:30- 9:30	Completion of Workgroup Statements and Recommendations

--Full Conference Reconvenes:

9:30-10:30	Reports by Workgroup Members of Group Discussion for Each Group
10:30-10:45	Break
10:45-12:45	Reports by Workgroup Members Continue
12:45- 1:00	Conference closing